SkillsUSA
2009 Contest Projects

Motorcycle Service Technology

Click the “Print this Section” button above to automatically print the specifications for this contest. Make sure your printer is turned on before pressing the button.

2009 HARLEY-DAVIDSON SKILLS USA COMPETITION
VALVE LASH WORKSHEET

Contestant # _____

VRSC Front & Rear Cylinder

				Current State			Corrected State
Valve Number (frt #'s 1 – 4) (rear #'s 5 – 8)	**Valve Type**	**Upper Lash Limit**	**Lower Lash Limit**	**Initial Lash Measurement**	**Installed Shim Measurement**	**New Shim Chosen**	**New Valve Lash Measurement (Corrected Lash)**
1 or 7	**Exhaust**	**.345mm**	**.295mm**				
2 or 8	**Exhaust**	**.345mm**	**.295mm**				
3 or 5	**Intake**	**.245mm**	**.195mm**				
4 or 6	**Intake**	**.245mm**	**.195mm**				

REMEMBER TO ALWAYS TARGET THE UPPER LIMIT OF THE VALVE LASH RANGE AS VALVE LASH TENDS TO DECREASE AS THE MILEAGE ON THE MOTORCYLE INCREASES.

Contestant Number_____ **JUDGE_____** **SCORE_____**

2009 SkillsUSA Championships

Motorcycle Service Technology Contest

Workstation 1

Precision Measuring
VRSC Valve Lash Adjustment
& VRSC Slipper Clutch Inspection

Sponsored by Harley-Davidson Motor Company

Skills USA
2009 Motorcycle Service Technology Contest
Workstation 1
Precision Measuring
VRSC Valve Lash Adjustment & Slipper Clutch Inspection

Objective Information Sheet

Time Limit 2 Hours

OBJECTIVE:

Given the tools, various engine components, workstation reference materials participants will demonstrate the necessary skills to correctly disassemble the necessary VRSC valve train components, adjust the valve lash, and reassemble those components along with a complete disassembly inspection, and reassembly of a VRSC Slipper Clutch. Participants will determine this by use of precision measuring, calculating, and reading interpretation to determine the correct shim size and the condition of the clutch plates, springs and components by comparing their results to the H-D manufacturing specifications listed.

SPECIFIC SKILLS:

The contestant will:

1. Properly select and use precision measuring, hand tools, and equipment.
2. Locate specifications of the components in the resource materials.
3. Correctly dissemble VRSC cylinder head valve train components.
4. Measure and adjust the valve lash on a VRSC cylinder head.
5. Correctly reassemble VRSC cylinder head valve train components.
6. Correctly disassemble a VRSC Slipper Clutch.
7. Inspect and measure clutch plates.
8. Measure the free length of the clutch springs.
9. Correctly reassemble a VRSC Slipper Clutch.
10. Calculate measurements and determine component condition.
11. Use tools and equipment properly and safely.

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Precision Measuring
VRSC Valve Lash Adjustment & Slipper Clutch Inspection

12. Clean and reorganize the work area.

Instructions to Judge

Set-Up:

1. The VRSC® Valve Lash & Slipper Clutch workstation tools consist of:
    a. Bench VRSC Cylinder head
    b. Bench VRSC Slipper Clutch Assembly
    c. "VRSC Cylinder Head Valve Lash Student Reference Guide"
    d. VRSC Valve Lash Worksheets (2)
    e. "VRSC Slipper Clutch Student Reference Guide"
    f. VRSC Slipper Clutch Worksheets (2)
    g. Shop towels
    h. Calculator
    i. Black Marker
    j. VRSC Intake & Exhaust Feeler gauges HD-47181
    k. Blue Point Angled Feeler Gauge Set
    l. 0-25mm Metric Micrometer
    m. 3/8" Ratchet
    n. 3/8" 2-3" extension
    o. 10mm 3/8" drive socket
    p. Extension Magnet
    q. 3/8" 40-200 in. lb. Torque Wrench Snap-on #QD2R200
    r. Clutch Hub Alignment Tool HD-45654
    s. 0-150mm Dial Caliper
2. The cylinder head & clutch assembly and all related items should be in plain view of the contestant. It is important all tools, necessary parts, and information be readily available and visible to the contestant.
3. VRSC Valve Shim container placed at a central location for all participants to access.
4. The reference material, tools, spare parts should be organized on the table.
5. Extra parts and miscellaneous equipment should be out of sight of the contestant.

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6. The judge needs to inspect the setting of the measuring equipment. The judge must insure all measuring equipment is zeroed.

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Inventory per Workstation 14 (fourteen workstations):

Qty.	Description	Part Number	Furnished by
1	VRSC Valve Lash Student Reference Guide		H-D
1	VRSC Slipper Clutch Student Reference Guide		H-D
1	0-150mm Metric Dial Caliper	EDP 65910	H-D
1	VRSC Feeler gauge set	HD-47181	H-D
1	Angled Feeler Gauge	FB300A	H-D
1	0-25mm Metric Micrometer	230m	H-D
1	6” steel ruler	GAM2B	H-D
1	3/8” drive torque wrench	QD2R200	H-D
1	Feeler gage set	FB335	H-D
1	3/8” Dr extension	FXW4	H-D
1	Blue Point Extension Magnet	PT5B	H-D
1	3/8” dr 10mm shallow socket	FM10	H-D
1	3/8” dr ratchet	FB16	H-D

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VRSC Valve Lash Adjustment & Slipper Clutch Inspection

Contestant Worksheet

Contestant # _____

VRSC Valve Lash Adjustment (150 pts)

1. Prior to checking the initial valve lash the camshafts must be orientated to what positions?

_____

2. Record all your valve lash measurements on the worksheet provided following the steps outlined in the VRSC Valve Lash Student Reference Guide.

3. Using the "Valve Lash Student Reference Guide" briefly explain the purpose of the numbers and arrows that are associated with the camshaft journal caps.

    a. _____
    _____
    _____
    _____
    _____
    _____
    _____

4. Record the torque specification for the cam journal caps.

    a. Specification: _____

5. With a shim under bucket design; to increase the valve lash clearance a technician must find a smaller or larger shim? _____

6. With a shim under bucket design; to decrease the valve lash clearance a technician must find a smaller or larger shim? _____

Upon cylinder head reassembly you are ready to move on to the Slipper Clutch Inspection.

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VRSC Valve Lash Adjustment & Slipper Clutch Inspection

VRSC Slipper Clutch Inspection (150pts)

1. Record all your clutch component inspection measurements on the worksheet provided following the steps outlined in the VRSC Slipper Clutch Student Reference Guide.

2. The damper spring is installed onto the damper spring seat with the concave side? _____

3. There are two unique Friction Plates. How are these installed in relationship to the other friction plates?

   _____
   _____
   _____
   _____
   _____
   _____
   _____

4. In which direction should the steel plates be installed?

   _____
   _____
   _____
   _____
   _____
   _____
   _____

5. Per your answer above; why should the steel plates be installed this way?

   _____
   _____
   _____
   _____
   _____
   _____
   _____

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VRSC Valve Lash Adjustment & Slipper Clutch Inspection

6. Describe where the larger inside diameter steel plate is installed within the clutch assembly?

   _____
   _____
   _____
   _____
   _____
   _____
   _____

This completes the Harley-Davidson Precision Measuring Workstation.

Stop: Leave your worksheets and pencil with the judge.

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Workstation 1
Precision Measuring
VRSC Valve Lash Adjustment & Slipper Clutch Inspection

Judge's Score sheet

Contestant #_____ Start Time:_____

Judge's Initials:_____ Stop Time:_____

Scoring Directions: Use the scoring criteria outlined below.

"0" indicates the contestant ***could not*** perform this skill.
"10" or "25" indicate that the contestant ***could*** perform the skill or correctly answered the question and was awarded the total score.

"15" indicates that the contestant **could partially** perform the skill for the Valve Lash Adjustment

PERFORMANCE: VRSC VALVE LASH ADJUSTMENT (150 PTS)

1 Accurately identified the two (2) positions necessary to establish the camsahft base circle prior to measuring the valave lash.

Total Number of Points _____(0,10)

2 Accurately measured and recorded Valve Lash, Valve Shims, and made appropriate changes to valve lash components. Compare student measurements in all recorded columns to factory specifications listed in the table. Place a check mark √ in the appropriate space to indicate a good measurement was obtained towards the higher end of the specification and the full score amount of 25. Or place a check-minus √- to indicate a measurement that is narrowly out of specification allocating a partial score amount of 15. Or place an X in the space to indicate an inaccurate measurement and a zero score.

Valve Number (frt #'s 1 – 4) (rear #'s 5 – 8)	Valve Type	**Upper Lash Limit**	**Lower Lash Limit**	Initial Lash Measurement	Installed Shim Measurement	New Shim Chosen	New Valve Lash Measurement (Corrected Lash)	**Score – (0, 15, 25) pts each**
1 or 7	Exhaust	**.345mm**	**.295mm**					
2 or 8	Exhaust	**.345mm**	**.295mm**					
3 or 5	Intake	**.245mm**	**.195mm**					
4 or 6	Intake	**.245mm**	**.195mm**					

Total Number of Points _____
(0,15, 25,30, 45, 50,65,75,80,95,100)

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VRSC Valve Lash Adjustment & Slipper Clutch Inspection

3 Using the Valve Lash Student Reference Guide briefly explain the purpose of the numbers and arrows that are associated with the camshaft journal caps. The camshaft journals are line bored as an assembly prior to the final machining processes. Each cap has a cast in numbered for its location and the cylinder head is casted with a corresponding numbers. The cam journals are also casted with an arrow to indentify the direction that each journal should be installed. The directional arrows will point to the cylinder head spark plug hole for proper installation.

Total Number of Points _____(0,10)

4 Correctly recorded, assembled, and torqued the cam journal caps.
   a. Specification: _9.7 Nm (86 in-lbs)_

Total Number of Points _____(0,10)

5 With a shim under bucket design; to increase the valve lash clearance a technician must find a smaller or larger shim? _Smaller

Total Number of Points _____(0,10)

6 With a shim under bucket design; to decrease the valve lash clearance a technician must find a smaller or larger shim? _Larger

Total Number of Points _____(0,10)

(Combined Total Possible Score for VRSC Valve Lash 150)

Contestant Total Score for VRSC Valve Lash _____

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Workstation 1
Precision Measuring
VRSC Valve Lash Adjustment & Slipper Clutch Inspection

I. PERFORMANCE: VRSC SLIPPER CLUTCH INSPECTION (150 PTS)

7 1. Accurately measured and recorded clutch components. Compare student measurements in all recorded columns to factory specifications listed in the table. Place a check mark √ in the appropriate space to indicate a good measurement for each column and the full score amount of 25. Or place a check-minus √- to indicate a measurement that is narrowly out of specification allocating a partial score amount of 15. Or place an X in the space to indicate an inaccurate measurement and a zero score.

Areas of Inspection	Measurements / Specification									Score – (0, 15, 25) pts each
Clutch Spring Free Length										
Factory Spec.: mm	42mm		42mm		42mm		42mm			
Clutch Friction Plates										
Factory Spec.: mm	3.62mm	3.62mm	3.62mm	3.62mm	3.62mm	3.62mm	3.62mm	3.62mm	3.62mm	
Steel Plates Warpage										
Factory Spec.: mm	0.15mm	0.15mm	0.15mm	0.15mm	0.15mm	0.15mm	0.15mm	0.15mm		

Total Number of Points _____
(0,15, 25,30, 45, 50,65,75)

2. The damper spring is installed onto the damper spring seat with the concave side? Up

Total Number of Points _____(0,10)

3. There are two unique Friction Discs. How are these installed in relationship to the other friction discs?
The two unique friction plates are installed as the first and last plate among the other clutch plates within the entire clutch assembly.

Total Number of Points _____(0,10)

4. In which direction should the steel plates be installed?
The steel plates should be installed with the rounded side towards the direction for clutch disengagement – i.e. in towards the clutch basket.

Total Number of Points _____(0,10)

5. Per your answer above; why should the steel plates be installed this way?
Installing the steel plates with the rounded side facing the direction of disengagement helps improve clutch disengagement. The opposing side of the steel plate has a sharp edge due to the manufacturing process of stamping the

plates. This edge could cause drag or added resistance when disengaging the clutch.

Total Number of Points _____(0,10)

6. Describe where the larger inside diameter steel plate is installed within the clutch assembly?
   The larger diameter steel plate is installed after a unique narrow spaced friction plate on the pressure plate side.

Total Number of Points _____(0,10)

(Combined Total Possible Score for VRSC Slipper Clutch 150)

Contestant Total Score for VRSC Slipper Clutch _____

(Combined Total Possible Score for VRSC Valve Lash & Slipper Clutch Inspection 300)

Contestant Total Score for VRSC Valve Lash & Slipper Clutch Inspection _____

2009 Harley-Davidson SKILLS USA Competition
VRSC Slipper Clutch Worksheet

Contestant # _____

VRSC Slipper Clutch Disassembly, Inspection, and Re-assembly

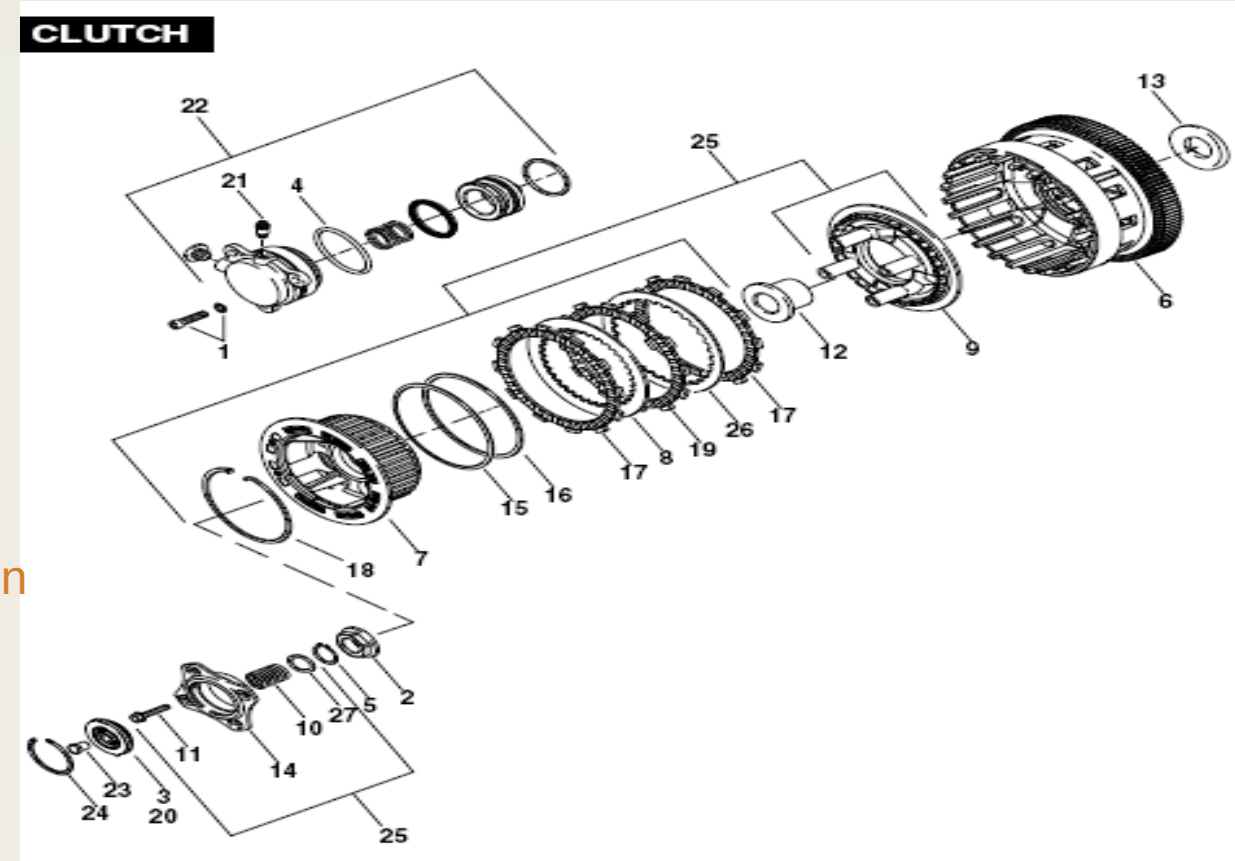
Instructions: Follow the applicable Student Reference Guide and the outlined procedures to correctly disassemble, inspect, measure, and re-assemble a VRSC clutch assembly.

Areas of Inspection	Measurements / Instructions									Comments / Results
Clutch Spring Free Length										
Factory Spec.: mm	42mm		42mm		42mm		42mm			
Clutch Friction Plates										
Factory Spec.: mm	3.62mm	3.62mm	3.62mm	3.62mm	3.62mm	3.62mm	3.62mm	3.62mm	3.62mm	
Steel Plates Warpage										
Factory Spec.: mm	0.15mm	0.15mm	0.15mm	0.15mm	0.15mm	0.15mm	0.15mm	0.15mm		

2009 SKILLS USA
Harley-Davidson VRSC Slipper Clutch Workstation
Student Reference Guide

VRSC Clutch Component Identification

- **#7** – Clutch Hub
- **#8** – Steel Plate (7)
- **#9** – Pressure Plate
- **#10** – Clutch Springs
- **#11** – Lifter Plate Fasteners
- **#14** – Lifter Plate
- **#15** – Damper Spring Seat
- **#16** – Damper Spring
- **#17** – (Narrow spaced) friction plate (2)
- **#19** – (Wide spaced) friction plate (7)
- **#26** – Large Inside Diameter Steel Plate (1)



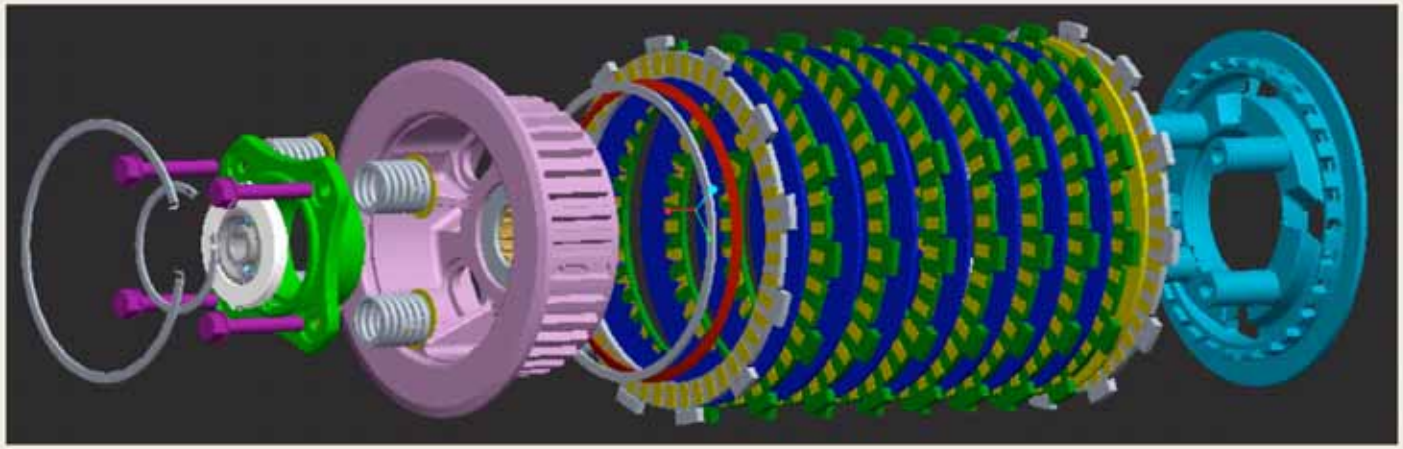
VRSC Clutch Disassembly

- **Remove lifter plate fasteners using a crisscross pattern.**

VRSC Clutch Disassembly

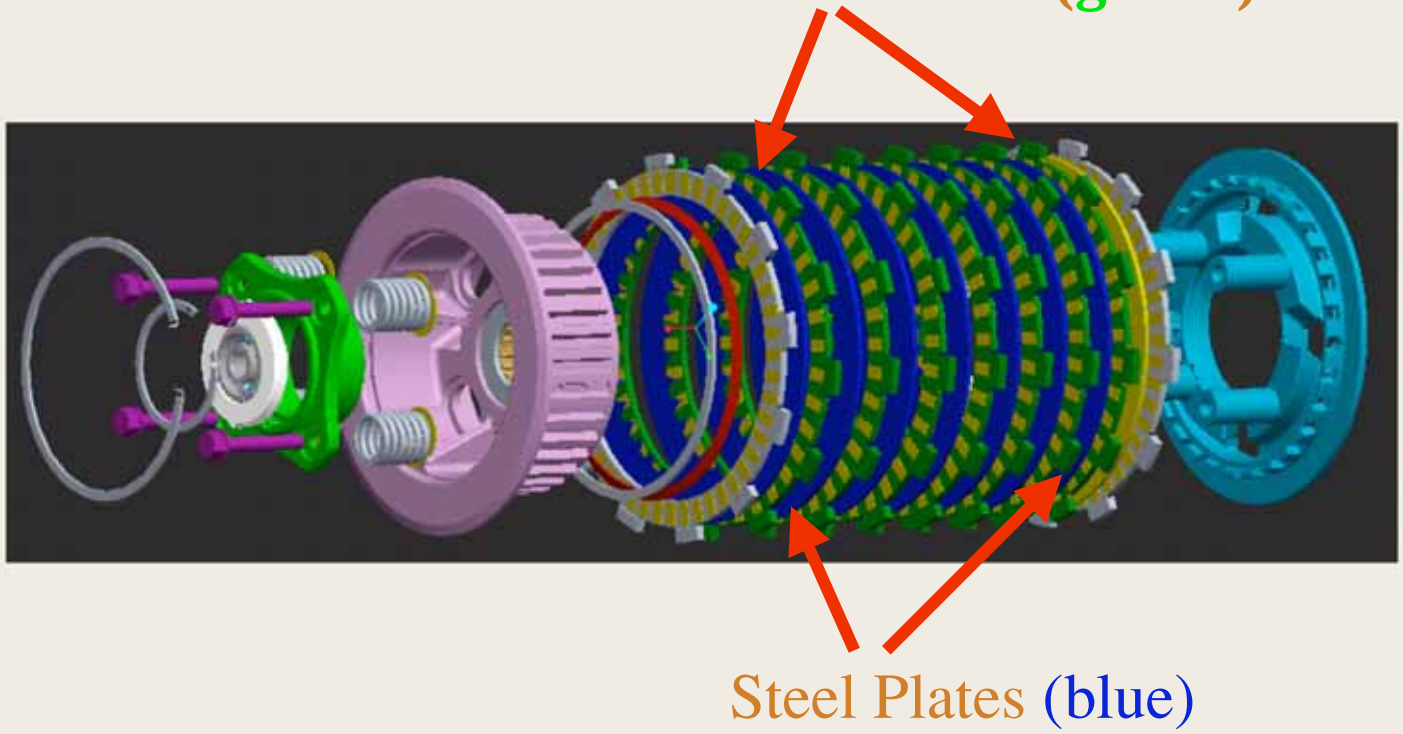
- Remove the clutch pack from the clutch basket.

Clutch Pack Assembly Break Down



VRSC Clutch Disassembly

- **Remove friction plates and steel plates for inspection**

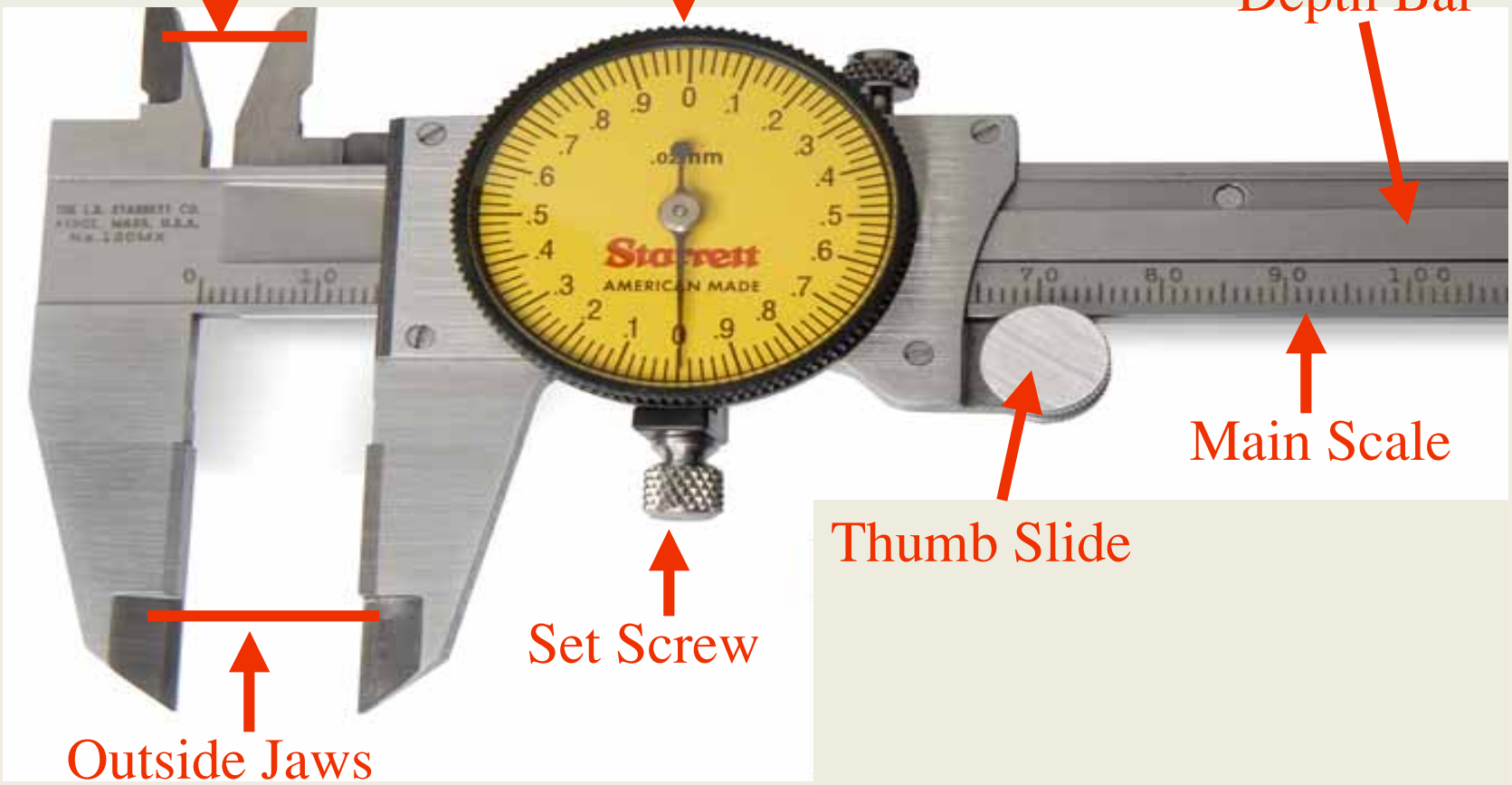


Metric Dial Caliper Reading

- The following pages are provided as a review section of the key points for using a Metric Dial Caliper.

- If you are confident and comfortable using a Metric Dial Caliper proceed to page 22 and begin.

Parts of a Dial Caliper



Using a Dial Caliper

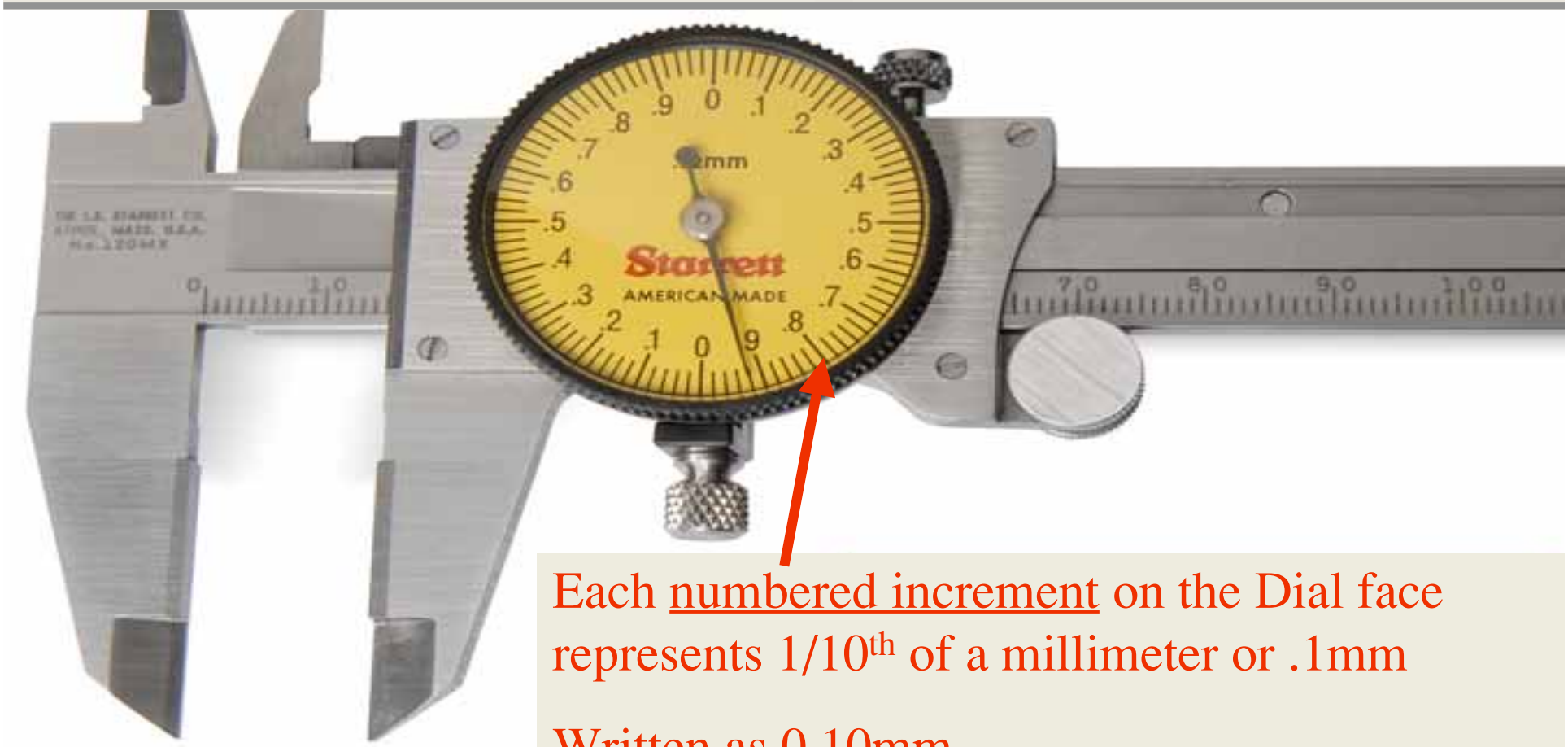
- The Dial Caliper is a convenient measuring instrument for making outside, inside, and depth measurements.

Reading a Metric Dial Caliper

Keep in Mind that the Metric system is built on a base 10 foundation.

Each graduation on the main scale represents 1 whole millimeter or 1mm. Written as 1.00mm

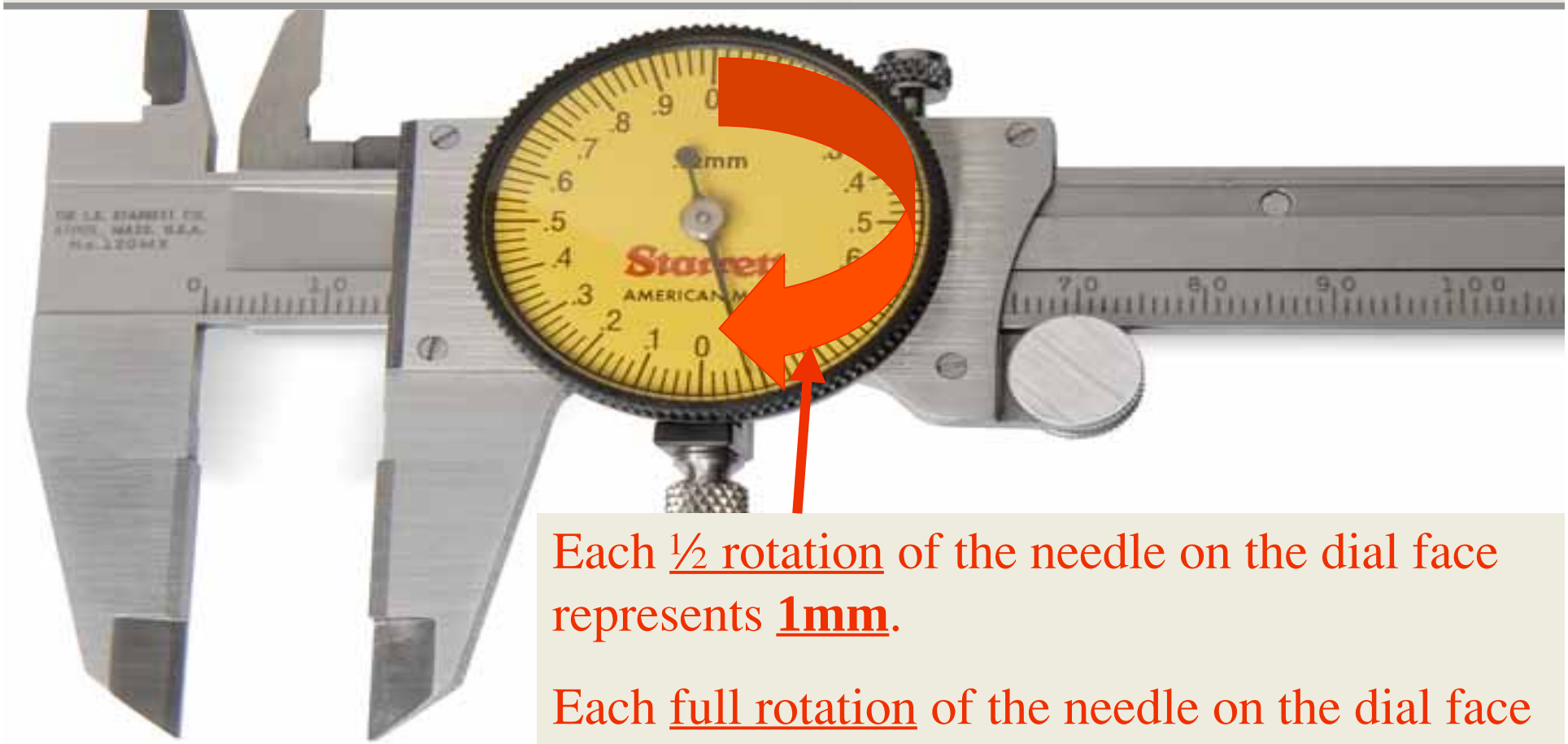
Reading a Metric Dial Caliper



Each <u>numbered increment</u> on the Dial face represents 1/10th of a millimeter or .1mm

Written as 0.10mm

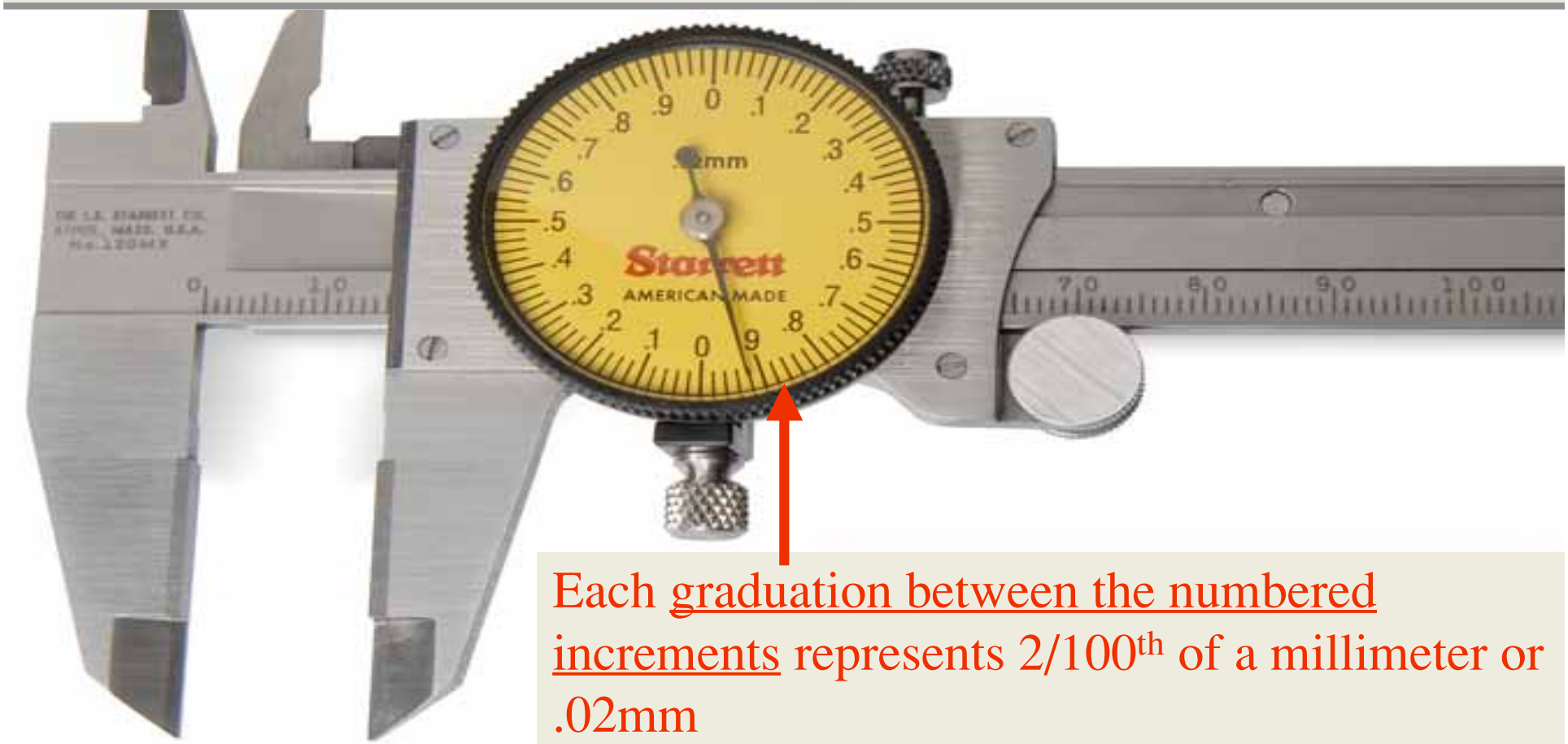
Reading a Metric Dial Caliper



Each ½ rotation of the needle on the dial face represents **1mm**.

Each full rotation of the needle on the dial face represents **2mm**

Reading a Metric Dial Caliper



Each graduation between the numbered increments represents 2/100th of a millimeter or .02mm

Written as 0.02mm

Reading a Metric Dial Caliper

1st - read the number of visible graduations on the main scale

14 graduations are visible

Written as 14.00mm

Reading a Metric Dial Caliper

2nd - read the 1/10th number increments on the Dial

The 9th increment is evident by the needles locations

Written as 0.90mm

Reading a Metric Dial Caliper

3rd - read the 1/100th graduations on the Dial

These graduations must be added together if the needle's position is further than 1 graduation from 1/10th number.

2/100ths is visible on the dial face

Written as 0.02mm

Reading a Metric Dial Caliper

4th – Add the numbers together

	14.00mm
+	**00.90mm**
+	**00.02mm**
=	**14.92mm**

Reading a Dial Caliper Summary and Review

13.00mm

+ 00.80mm

+ 00.04mm

= 13.84mm

Reading a Dial Caliper Summary and Review

26.00mm

\+ **00.60mm**

\+ **00.08mm**

= **26.68mm**

Reading a Dial Caliper Summary and Review

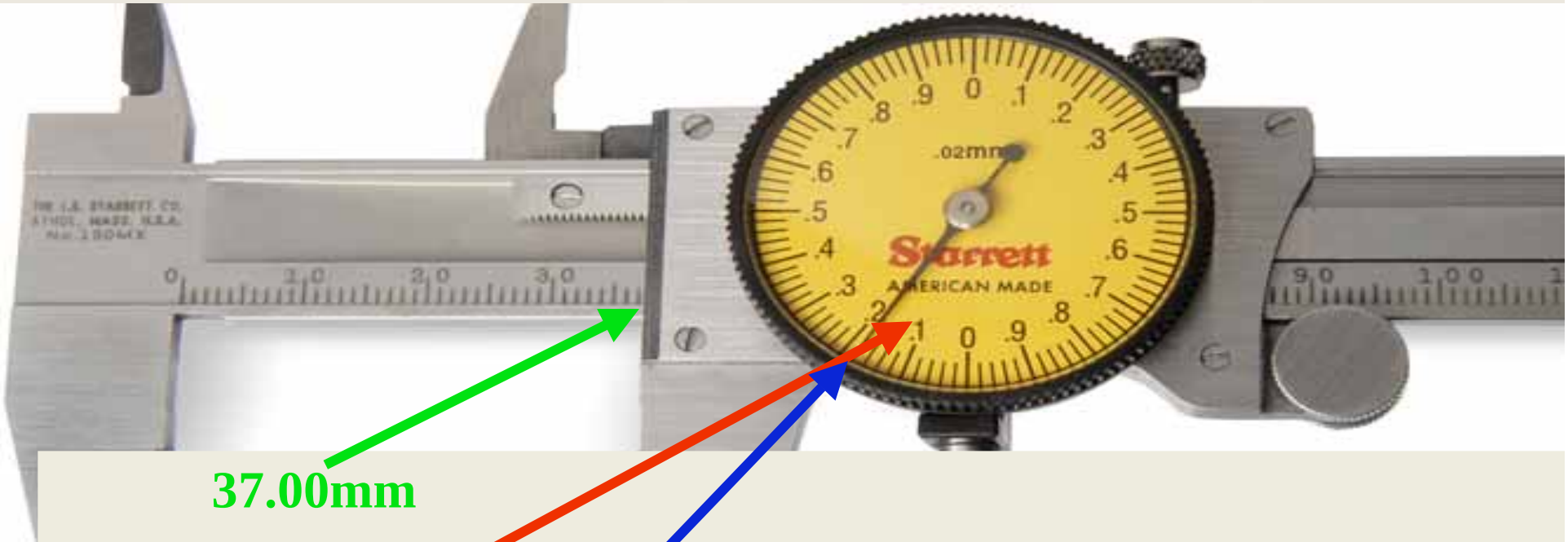
26.00mm

\+ **00.90mm**

\+ **00.04mm**

= **26.94mm**

Reading a Dial Caliper Summary and Review



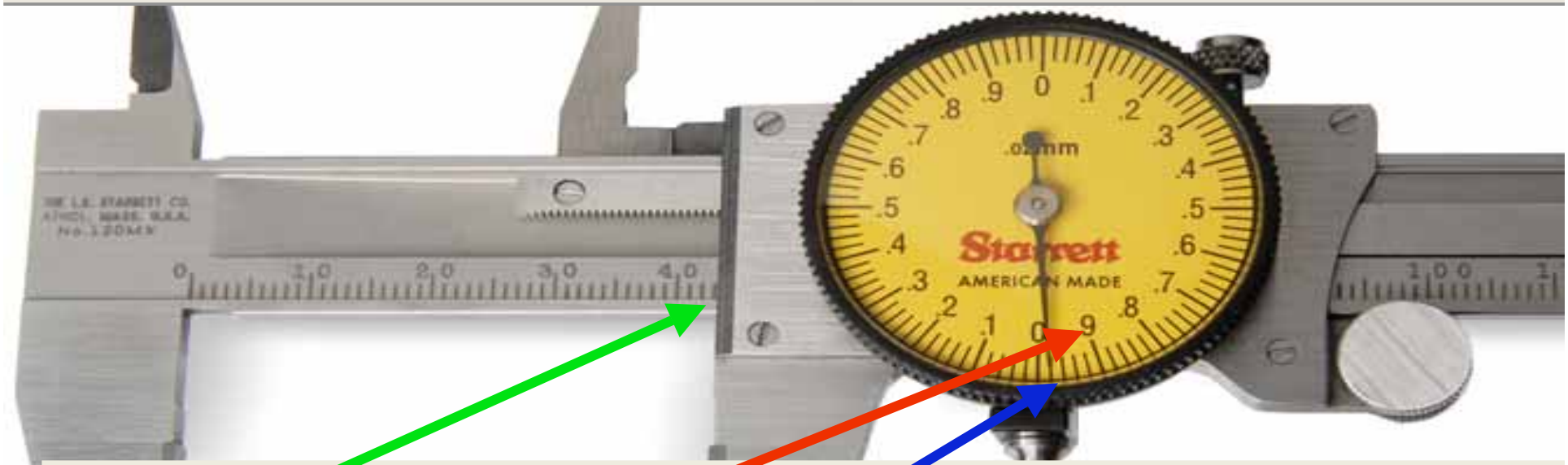
37.00mm

\+ 00.10mm

\+ 00.08mm

= 37.18mm

Reading a Dial Caliper Summary and Review



42.00mm

+ 00.90mm

+ 00.08mm

= 42.98mm

Clutch Component Inspection

- Record all your measurements on the worksheet provided.

1. Measure the Clutch Spring Free Length
2. Measure the thickness of the clutch friction plates.
3. Inspect the clutch steel plates for warpage.
4. Compare your measurements to the factory specifications listed on your worksheet to determine the overall condition of the clutch components.

Clutch Re-Assembly
Component Identification Assembly Notes

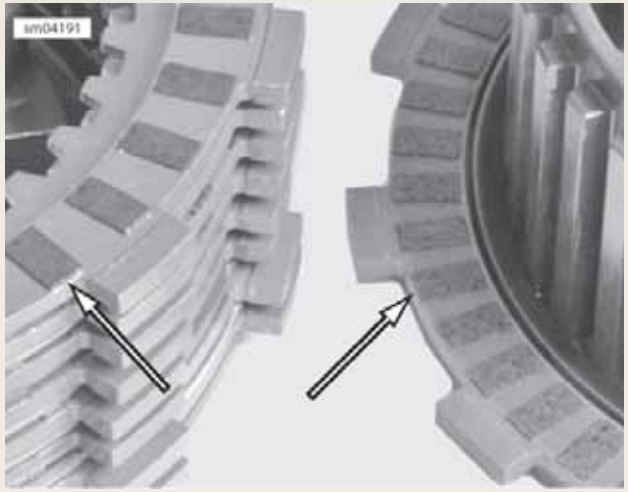
Important Component Identification Assembly Notes:

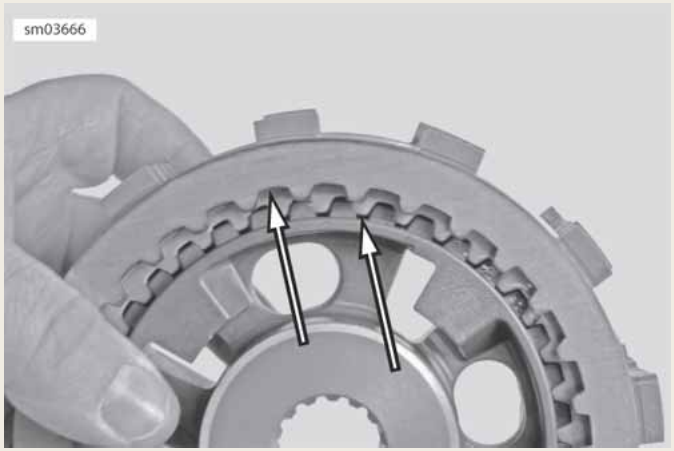
- 3 Unique clutch plates are utilized in the VRSC Slipper Clutch design.
- 2 friction plates use different spacing for the friction material compared to the remaining friction plates.
  - » The friction material spacing is closer together than the other friction plates.
  - » The assembly orientation for these 2 plates is also unique.
  - » (1) (narrow spaced) friction plate is installed first and the remaining plate is installed last during assembly.
- 1 steel plate that utilizes a larger inside diameter than that of the other steel plates.
- See the following page for more detail,

Clutch Re-Assembly
Component Identification Assembly Notes

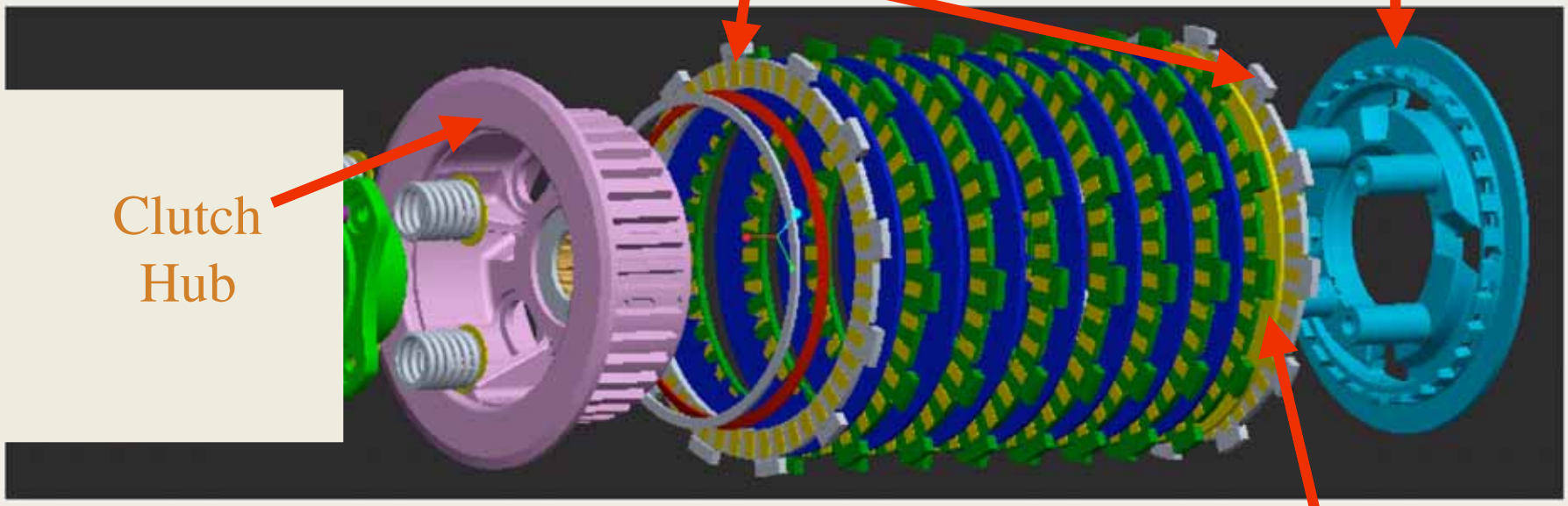
- **Note the different spacing on the friction plates.**
- The narrow spaced friction plates are installed 1st & last.

- **Note that 1 steel plate will have a larger I.D. than the remaining steel plates.**
- The inside diameter of the last steel plate prior to the narrow spaced friction plate will have a larger I.D.



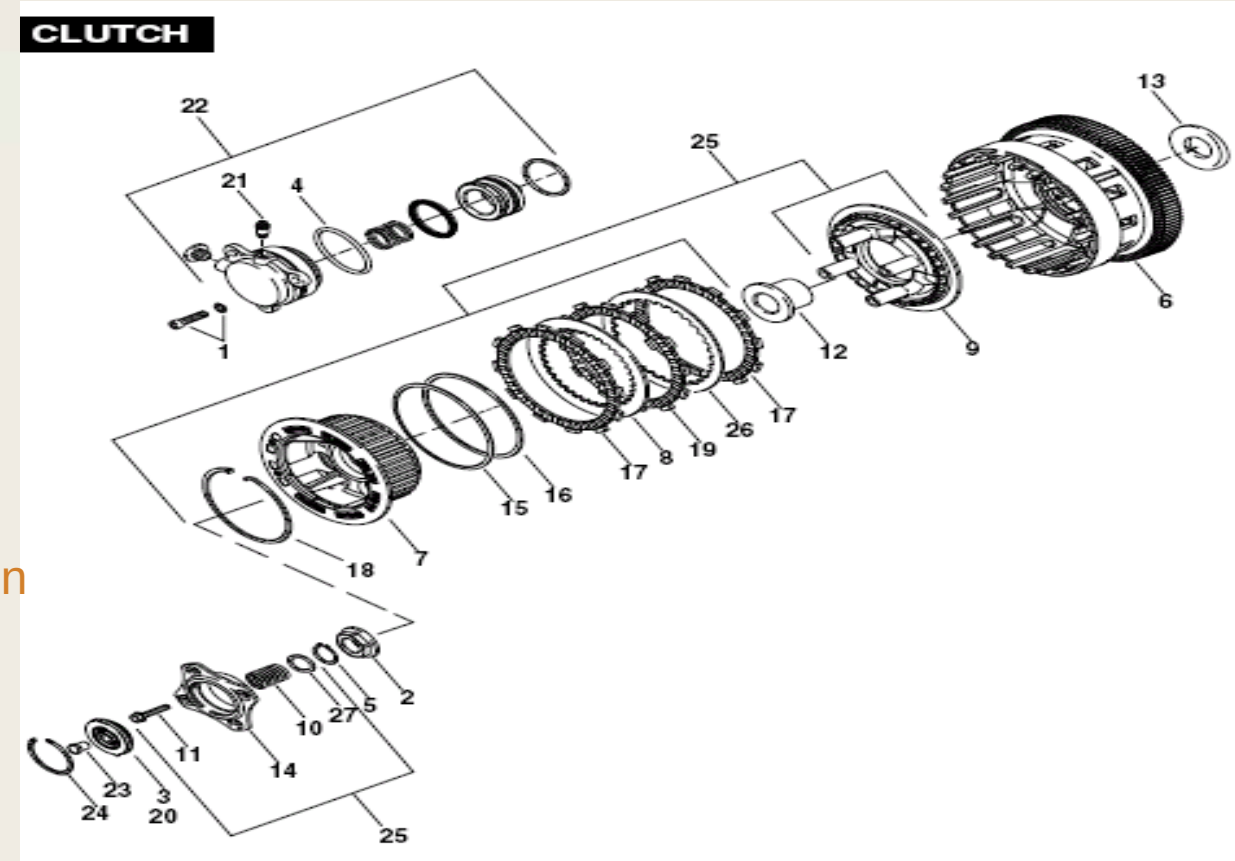


Clutch Assembly Overview



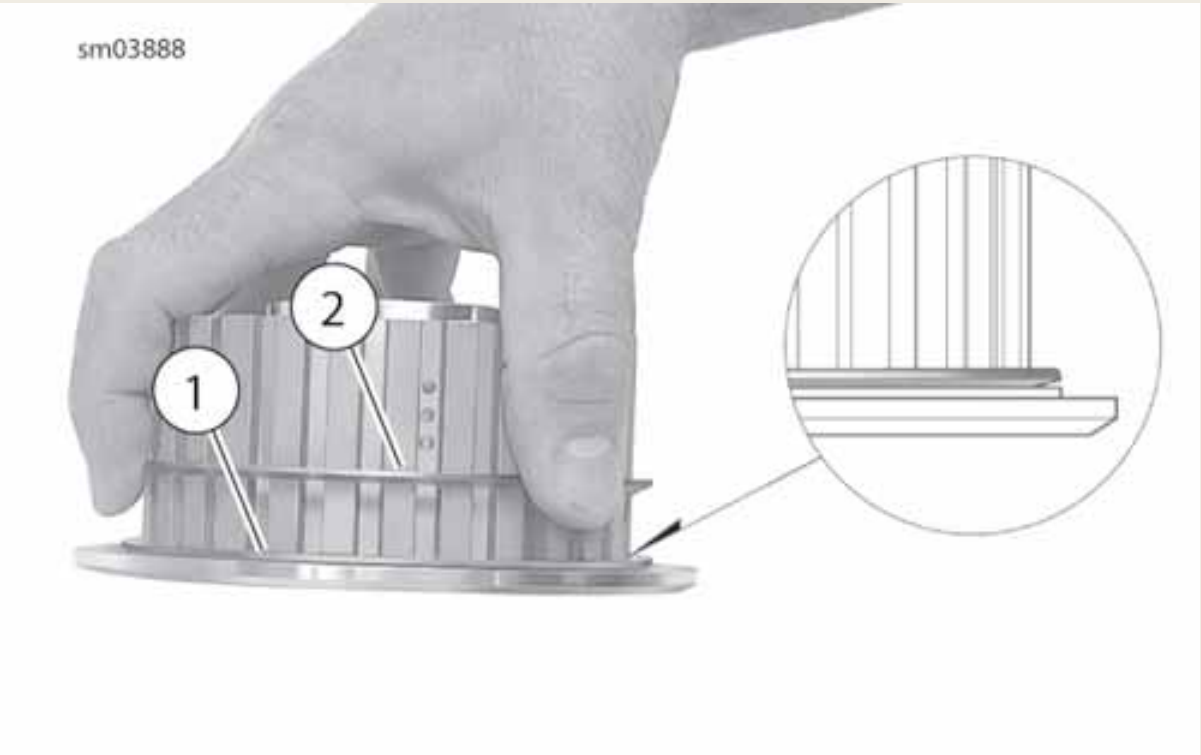
VRSC Clutch Component Identification

- **#7** – Clutch Hub
- **#8** – Steel Plate (7)
- **#9** – Pressure Plate
- **#10** – Clutch Springs
- **#11** – Lifter Plate Fasteners
- **#14** – Lifter Plate
- **#15** – Damper Spring Seat
- **#16** – Damper Spring
- **#17** – (Narrow spaced) friction plate (2)
- **#19** – (Wide spaced) friction plate (7)
- **#26** – Large Inside Diameter Steel Plate (1)



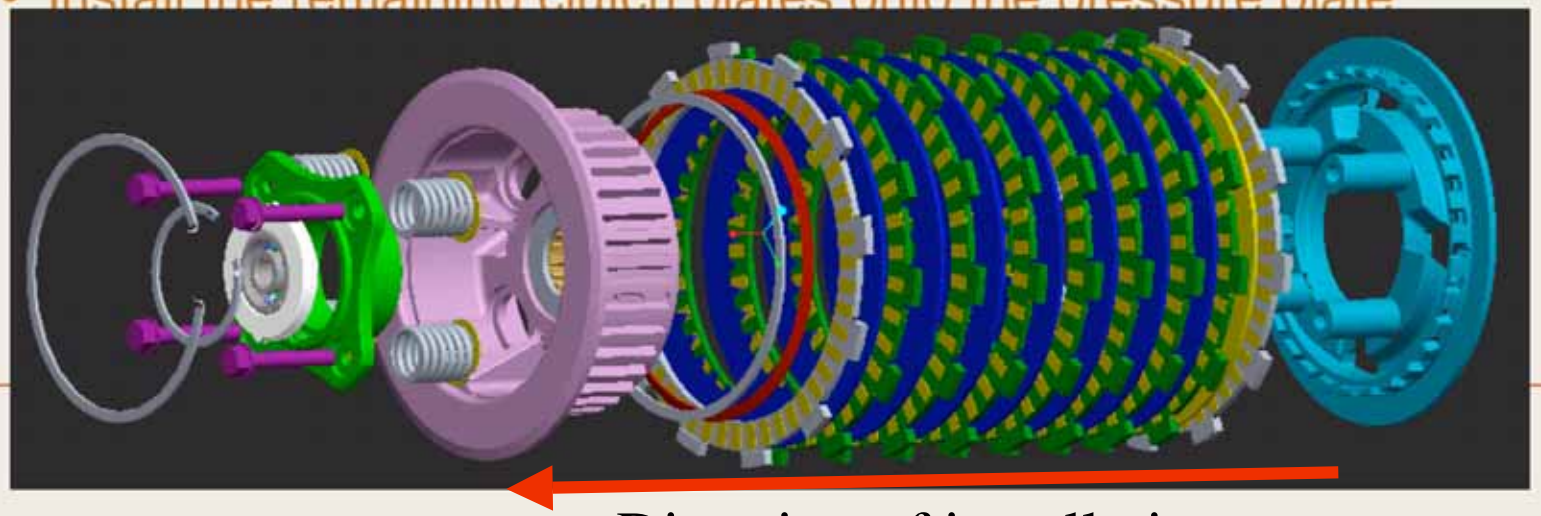
Clutch Re-Assembly

- Install **#15** Steel Damper Spring Seat.
- Install **#16** Damper Spring with **concave side up**.



Clutch Re-Assembly

- Install a narrow spaced friction plate
- Install 6 friction and 7 steel clutch plates; alternating between a friction plate and steel plate on the clutch hub.
  - » Note: Steel plates should be installed with the rounded side towards the pressure plate to ease clutch disengagement.
- Install the remaining clutch plates onto the pressure plate



Direction of installation

Clutch Re-Assembly

- Your assembled components should resemble the picture below.

Clutch Re-Assembly

- Slowly mate the pressure plate onto the clutch hub assembly until it is fully seated.

- DO NOT Force the clutch hub and pressure plate together – recheck the alignment of the clutch plate tabs to the hub and pressure plate do not align under their own weight.
- Verify that the clutch components are re-assembled correctly by checking for any visible gaps between the clutch plates.

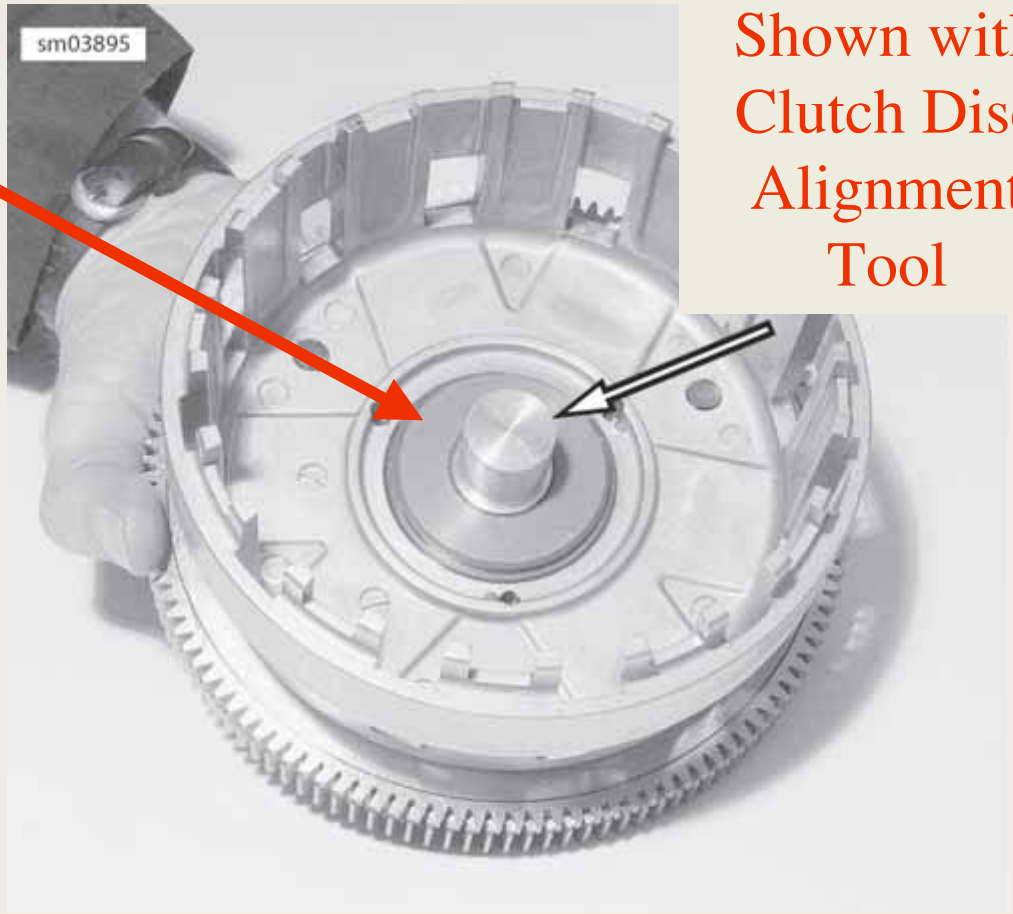
Check and verify that there are No visual gaps

Clutch Re-Assembly

- Re-assemble the outer lifter plate with the four bolts and the clutch springs.
- Gradually install the 4 fasteners using a crisscross pattern.
- **<u>Do NOT</u>** tighten the 4 fasteners - Leave the 4 fasteners loose at this point.

Clutch Re-Assembly

- Install the clutch hub spacer.
- **Note:** The photo is shown with the Clutch Disc Alignment Tool installed. This is not needed until the final alignment in the upcoming pages.



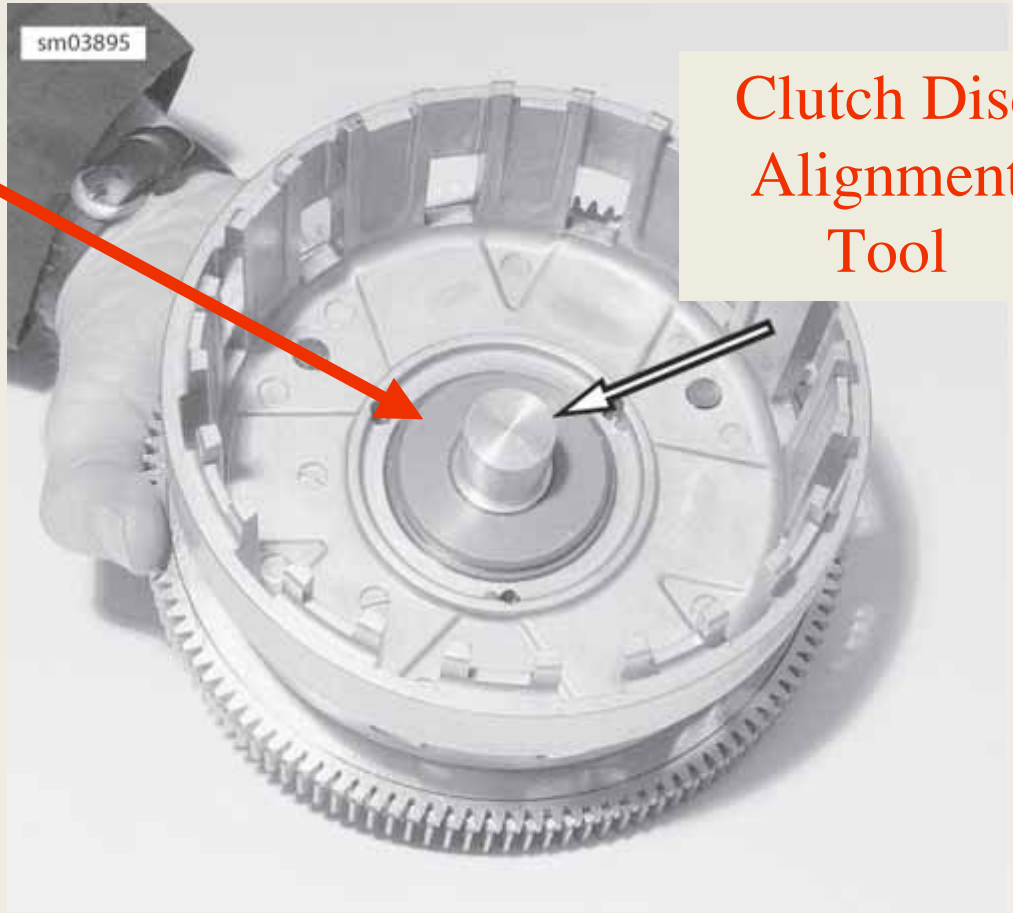
Shown with Clutch Disc Alignment Tool

Clutch Re-Assembly

- Prior to final assembly of the remaining clutch plates into the clutch basket note the assembly location of the top plate.
- The Top Clutch Plate **MUST** be installed into the top slot of the clutch basket as shown by the **RED** arrows.
- If the top clutch plate does not align with the slots references shift the plate in the appropriate direction to achieve this.

Clutch Re-Assembly

- Install the Clutch Disc Alignment Spacer into the back side of the clutch basket.
  - » This is used to center and square up the clutch pack to ease reassembly.



Clutch Re-Assembly

- Check your work
- Using a cross pattern tighten the 4 lifter plate fatteners to 9.7 Nm (86 in-lbs)

Clutch Re-Assembly

- Remove the Clutch Disc Alignment Spacer
- Double check your work
- Complete your worksheets
- Clean and organize your workstation and area.

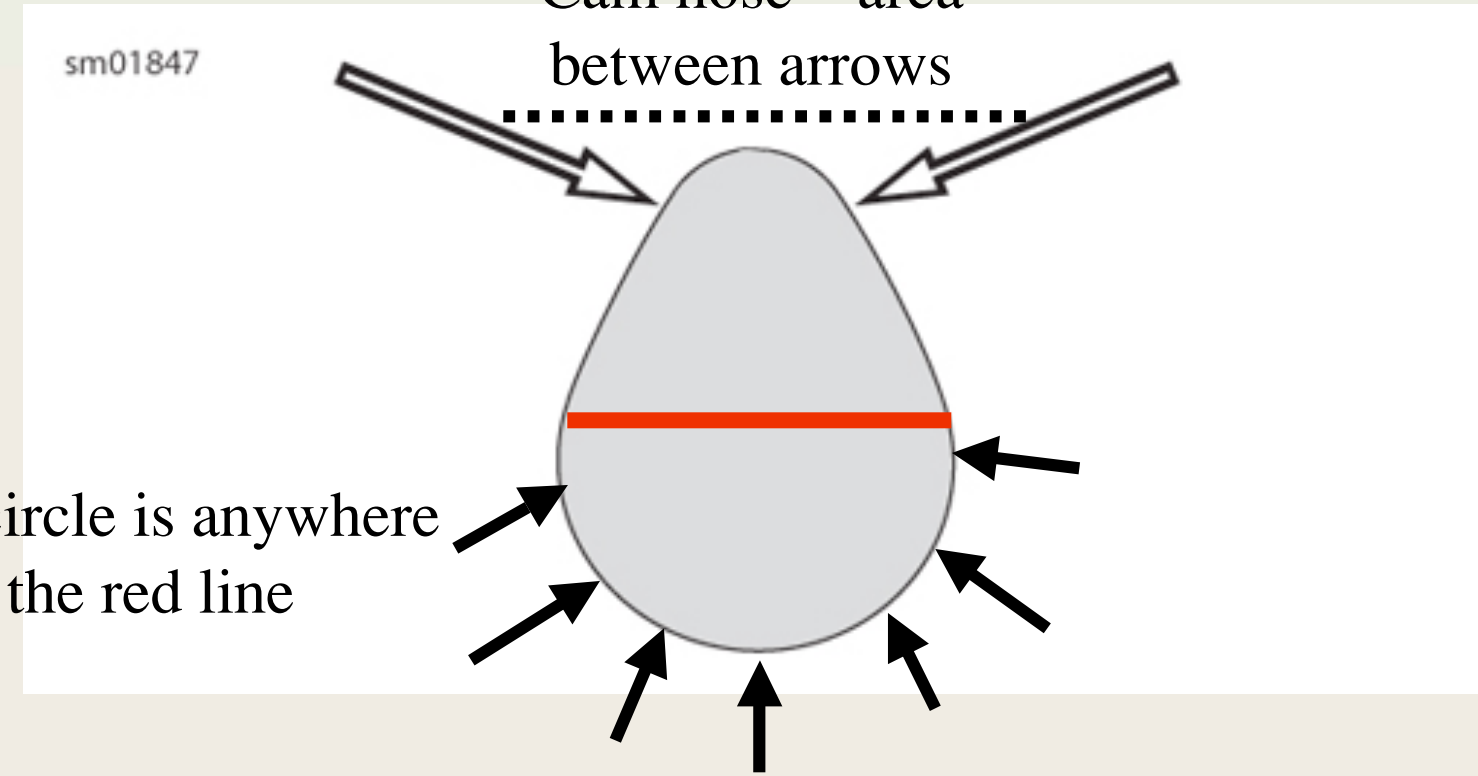
- Upon completion call the judge over to collect your worksheets and check your work area.

- **Congratulations!** You have completed this workstation.

SKILLS USA
Harley-Davidson VRSC Valve Lash Adjustment Workstation
Student Reference Guide

VRSC Valve Lash Instructions

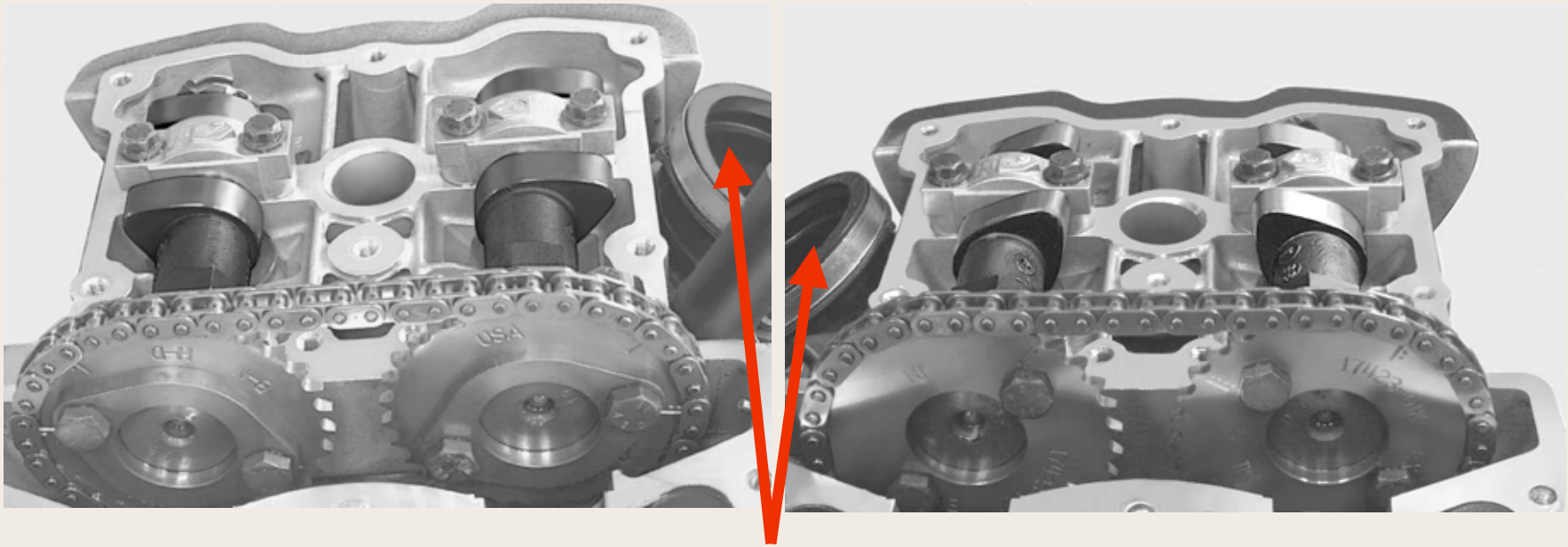
Cam nose – area between arrows



Base circle is anywhere below the red line

Front or Rear Cylinder Head Identification

Front and Rear Cylinder heads can be identified by the intake manifold that is pointed out below.

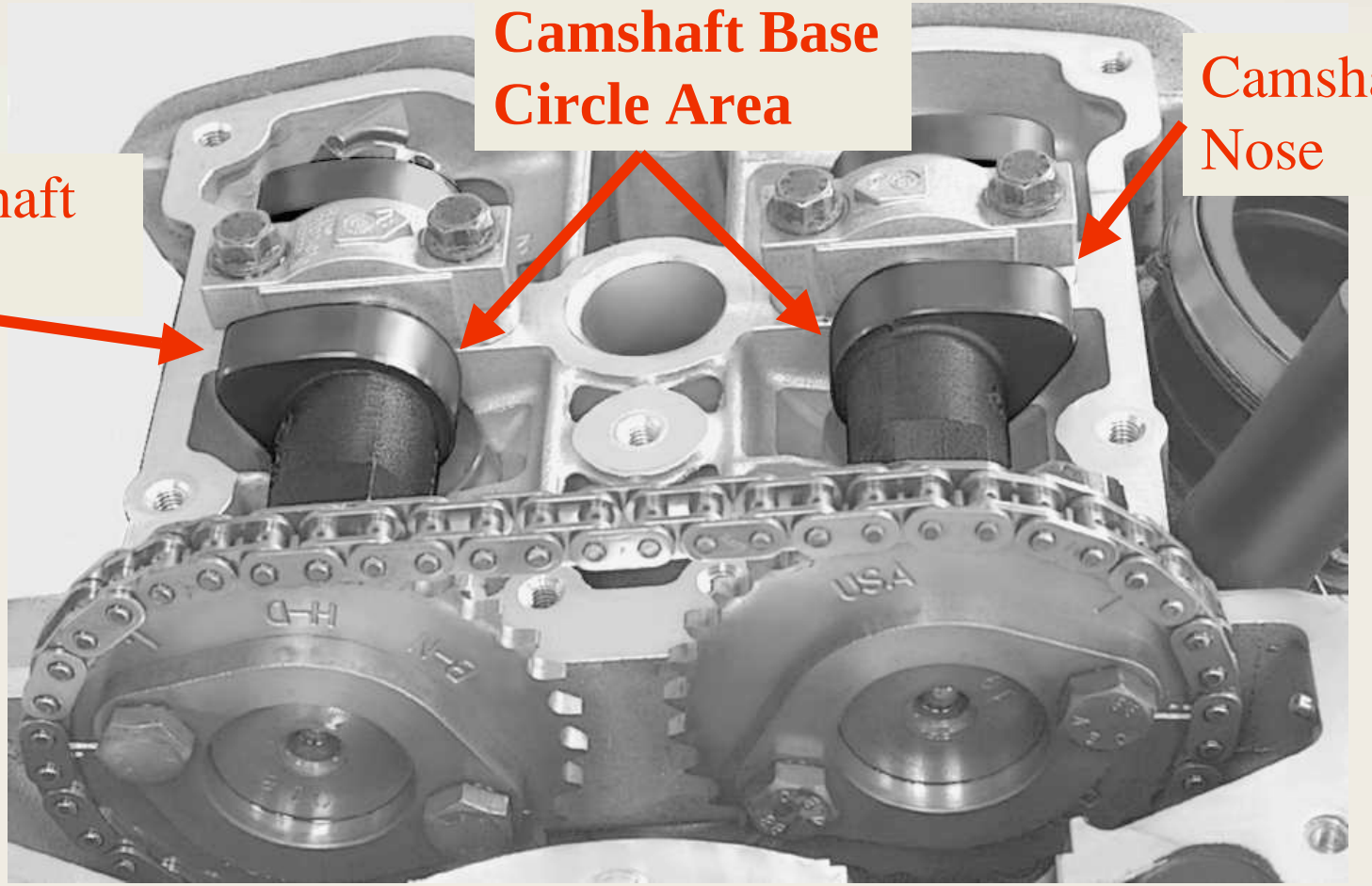


Front head

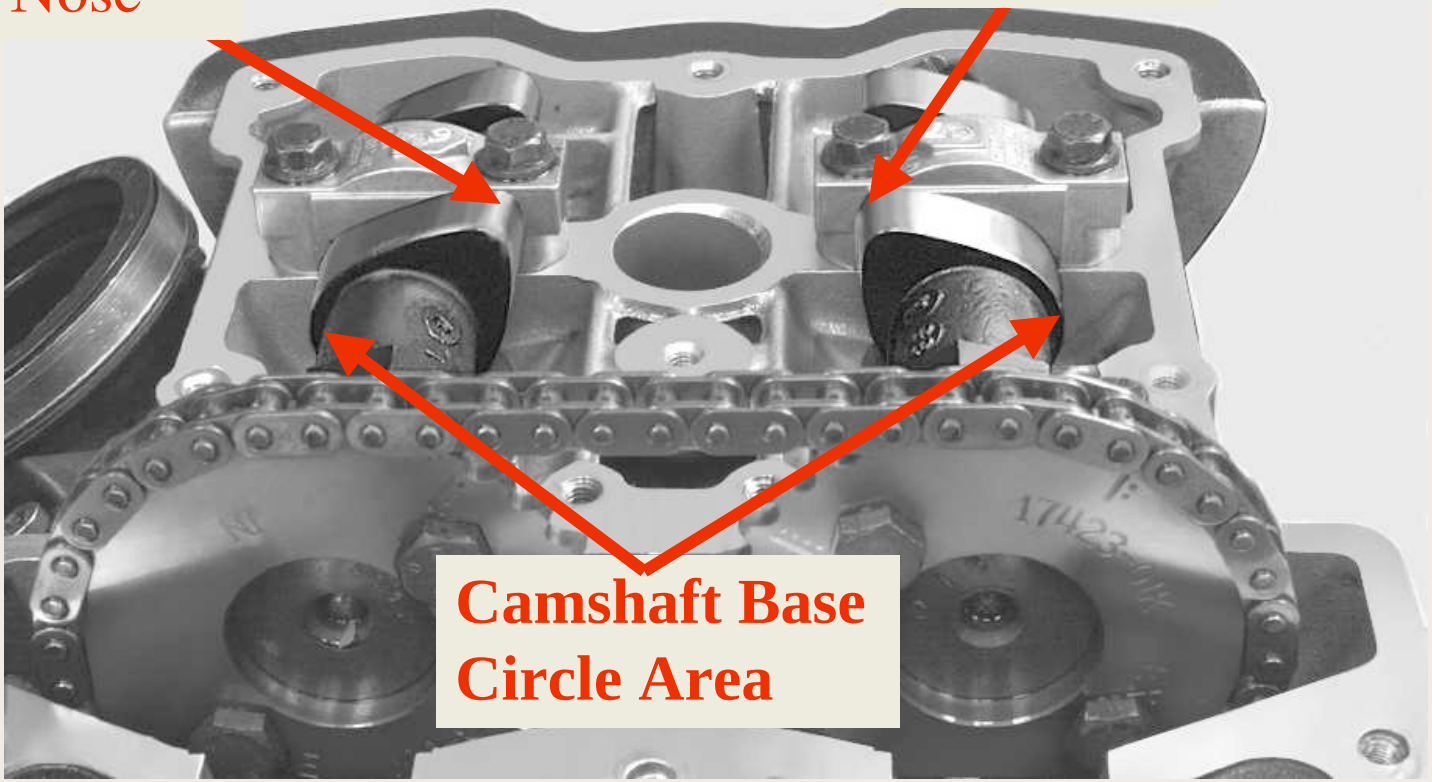
Intake Manifold

Rear head

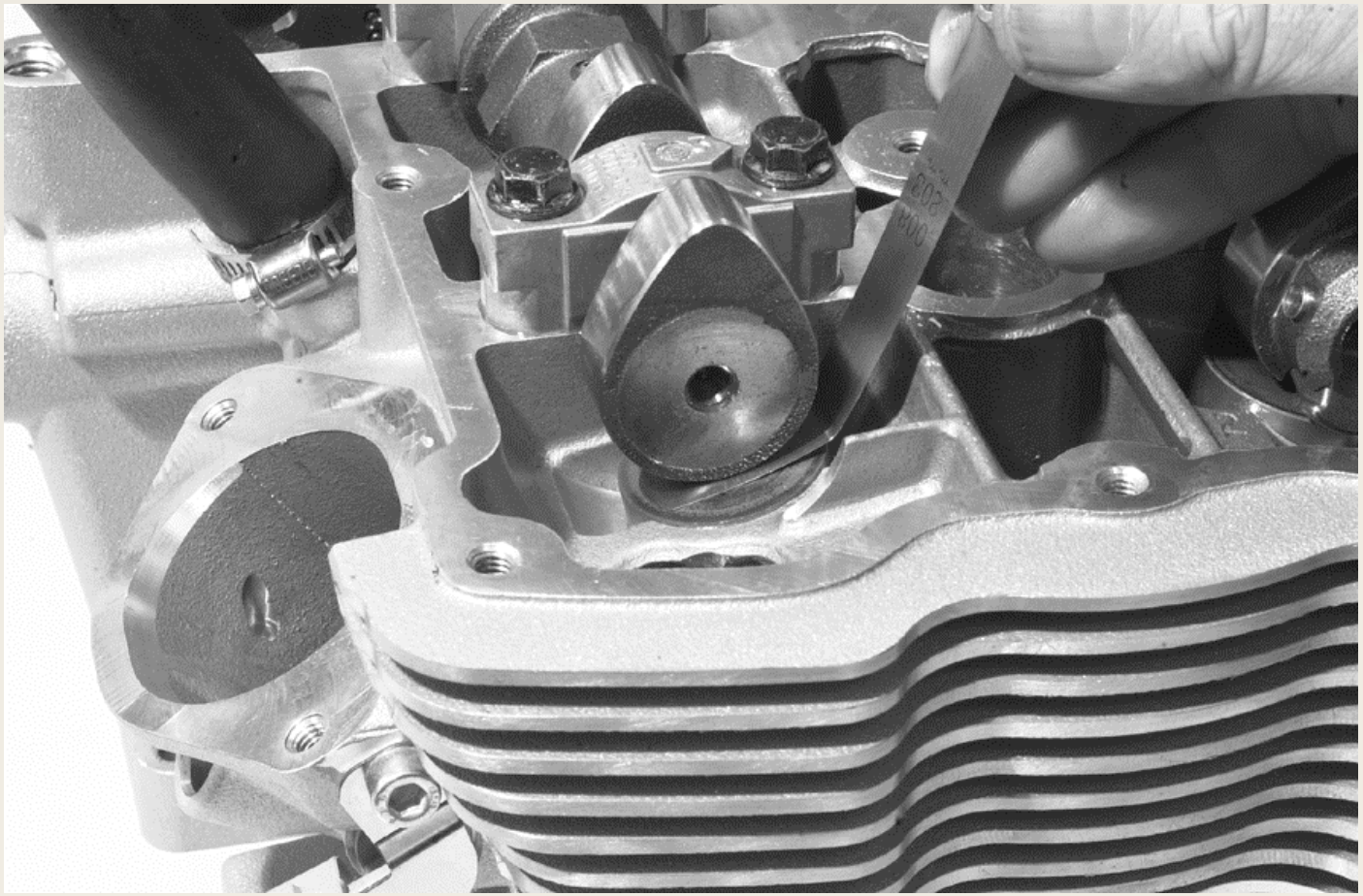
Front Cylinder Head Cam Position on Base Circle



Rear Cylinder Head Cam Position on Base Circle



Checking VRSC Valve Lash – Measurement with a feeler gauge



Recording your Valve Lash Measurement

2009 HARLEY -DAVIDSON SKILLS USA COMPETITION VALVE LASH WORKSHEET

VRSC Front Cylinder

Record your valve lash measurements in this column

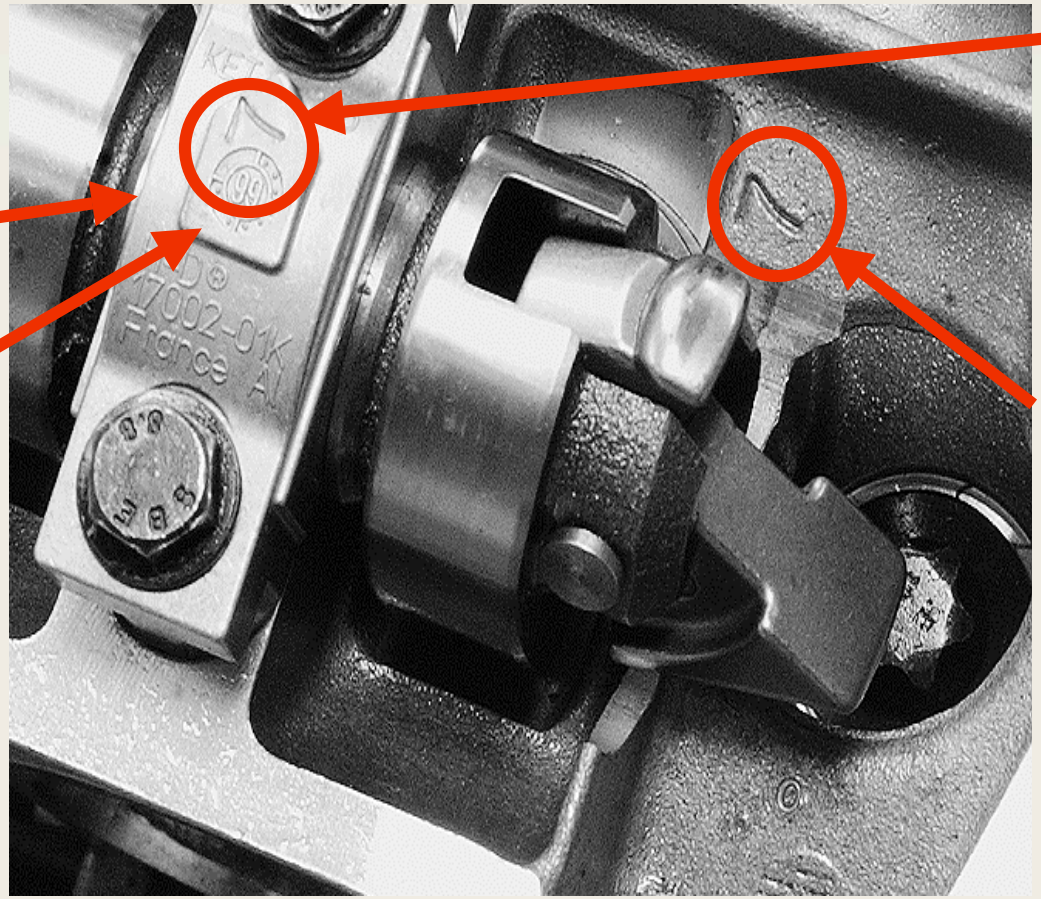
Current State **Corrected State**

REMEMBER TO ALWAYS VARY TO THE SIDE OF THE UPPER LIMIT OF THE VALVE LASH RANGE A S LASH TENDS TO GO LOWER AS THE MILEAGE ON THE MOTORCYLE INCREASES.

With a shim under bucket design; to increase valve lash does a technician need to find a smaller or larger shim? _____

With a shim under bucket design; to decrease valve lash does a technician need to find a smaller or larger shim? _____

Removing Camshaft Cam Journal Caps



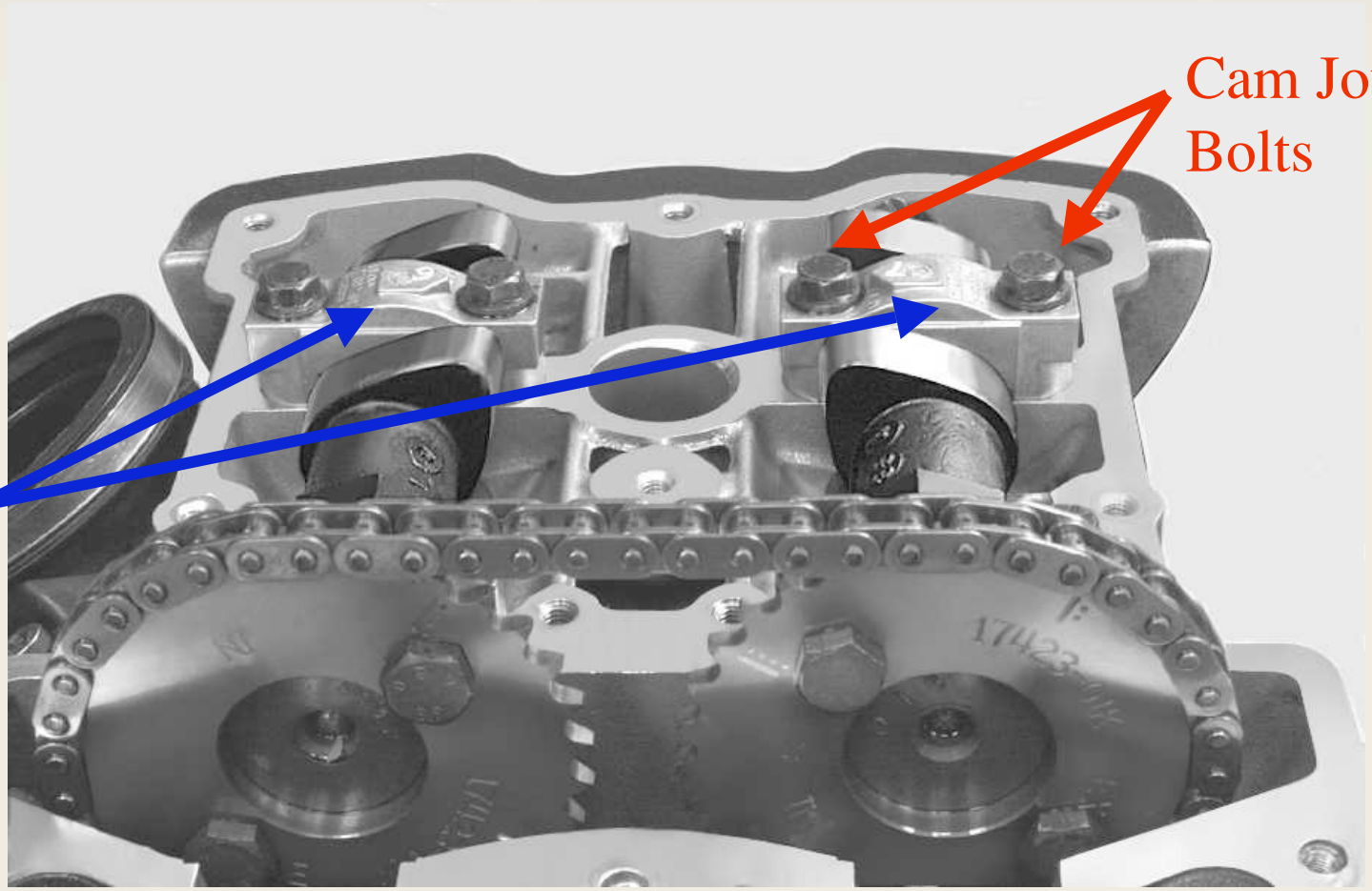
Cam Journal Cap

Cast in directional "Arrow"

Cast in assembly Location number

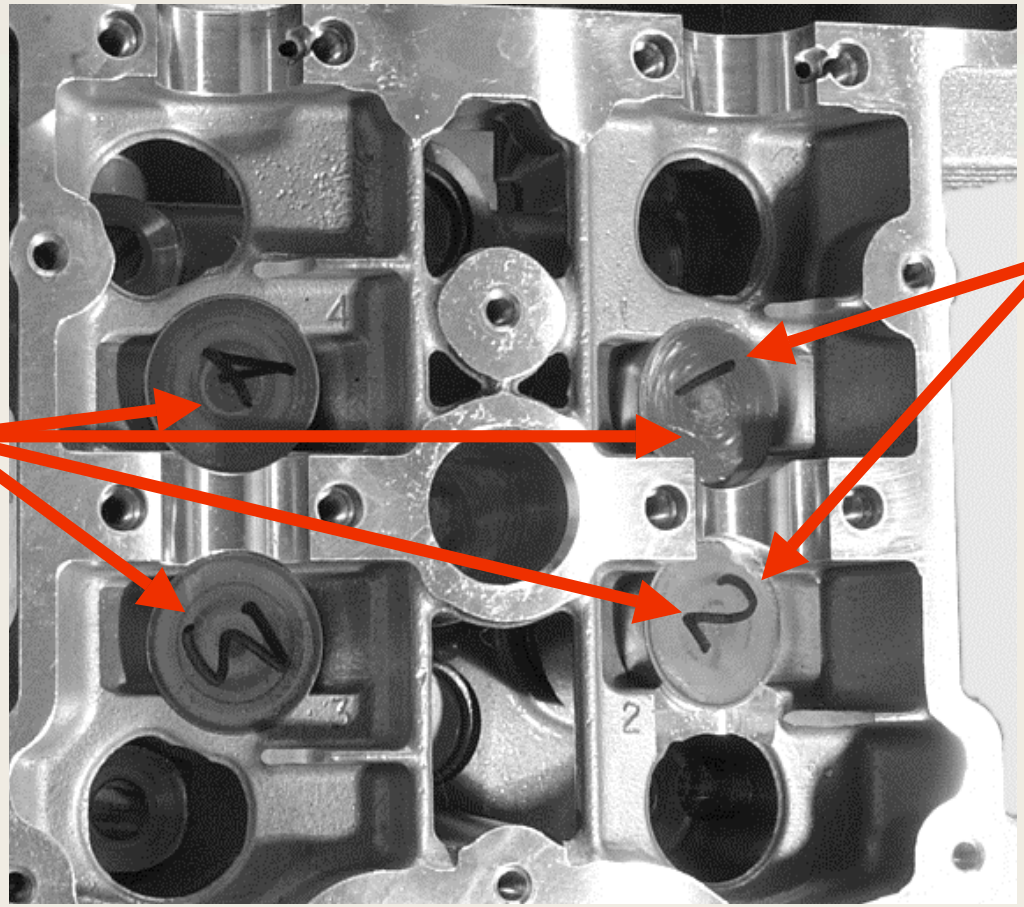
Corresponding Cast in Location Number

Remove all 4 Cam Journal Caps



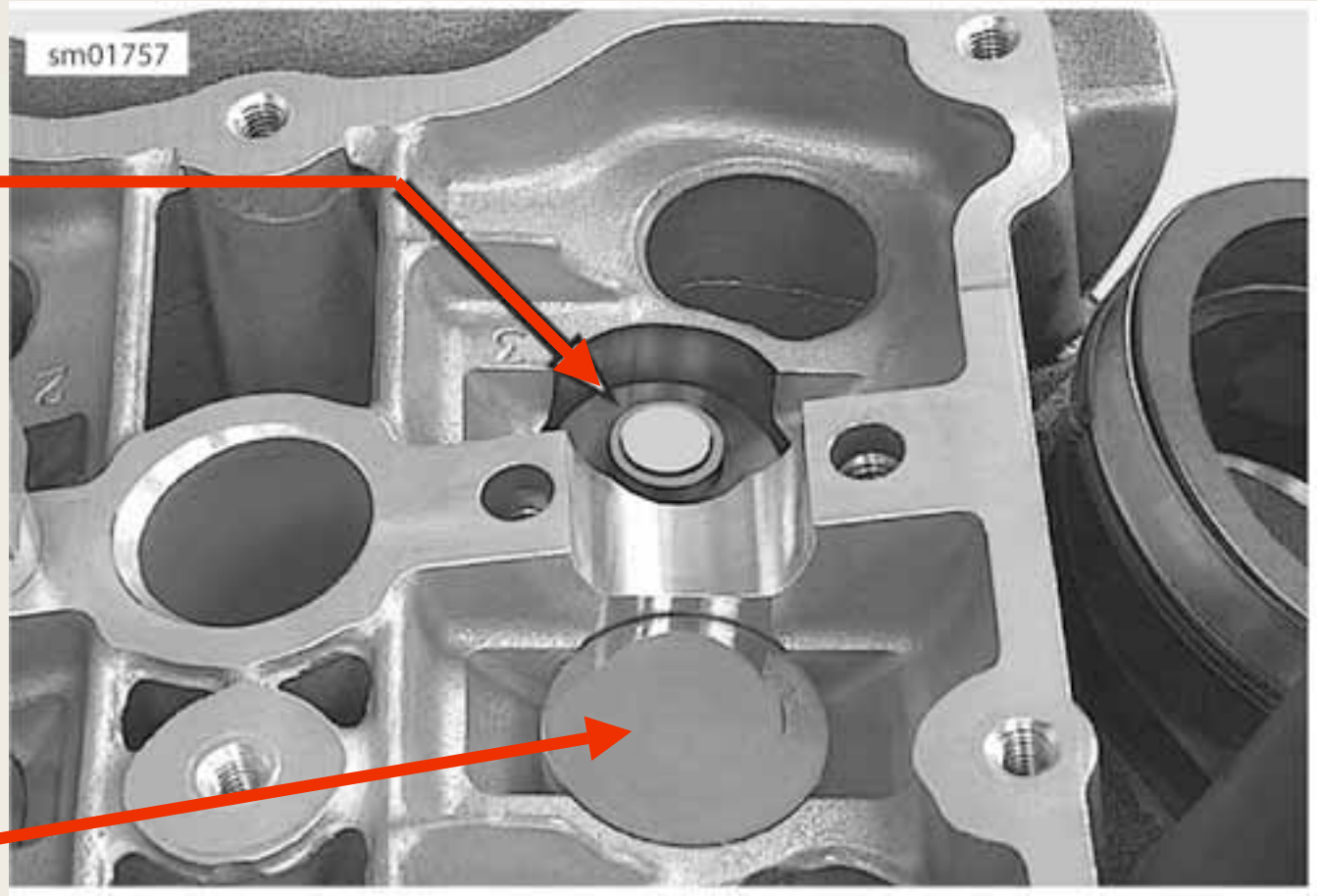
Removing the Valve Shim Buckets

Valve Shim Buckets

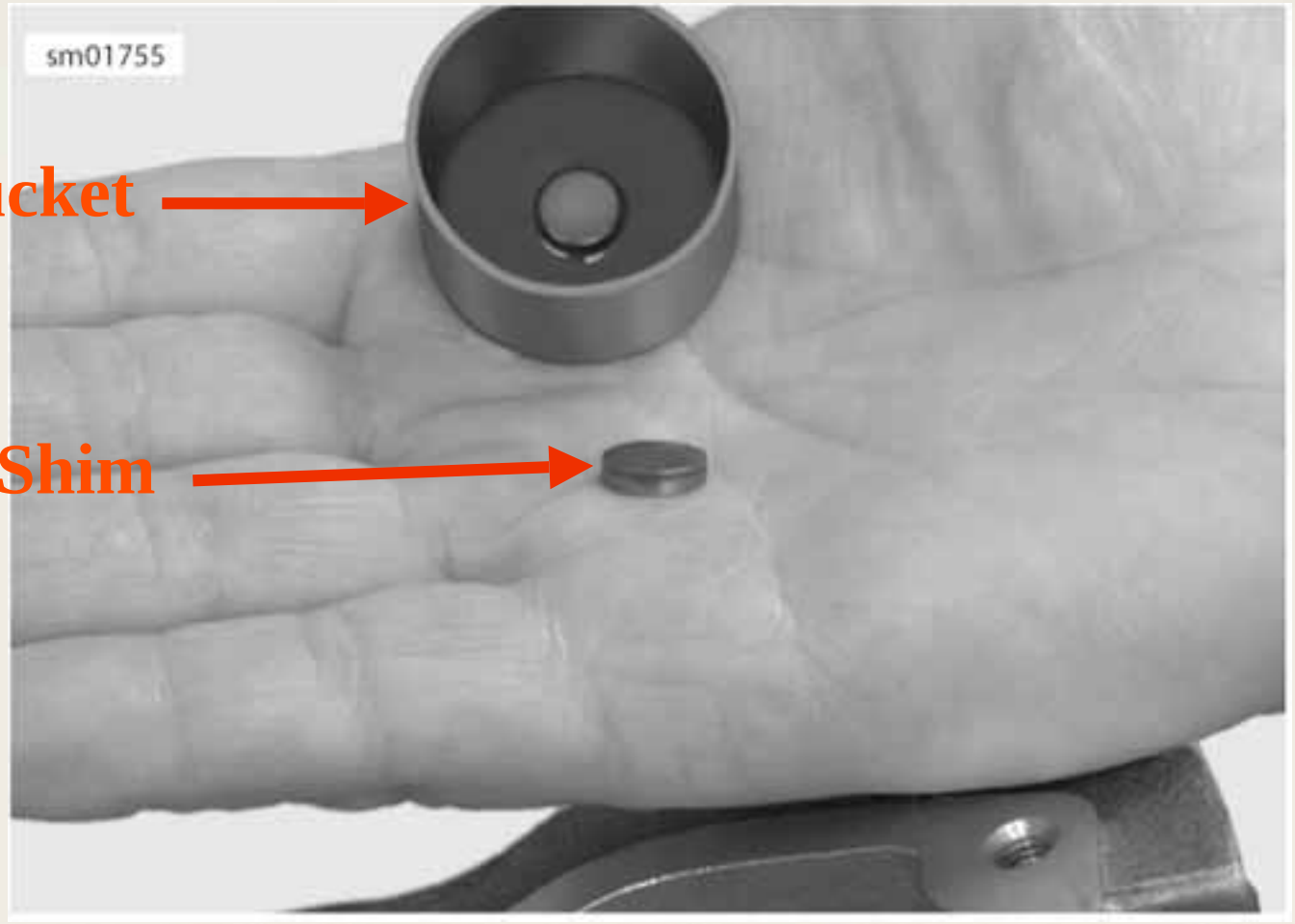


Written Bucket location numbers

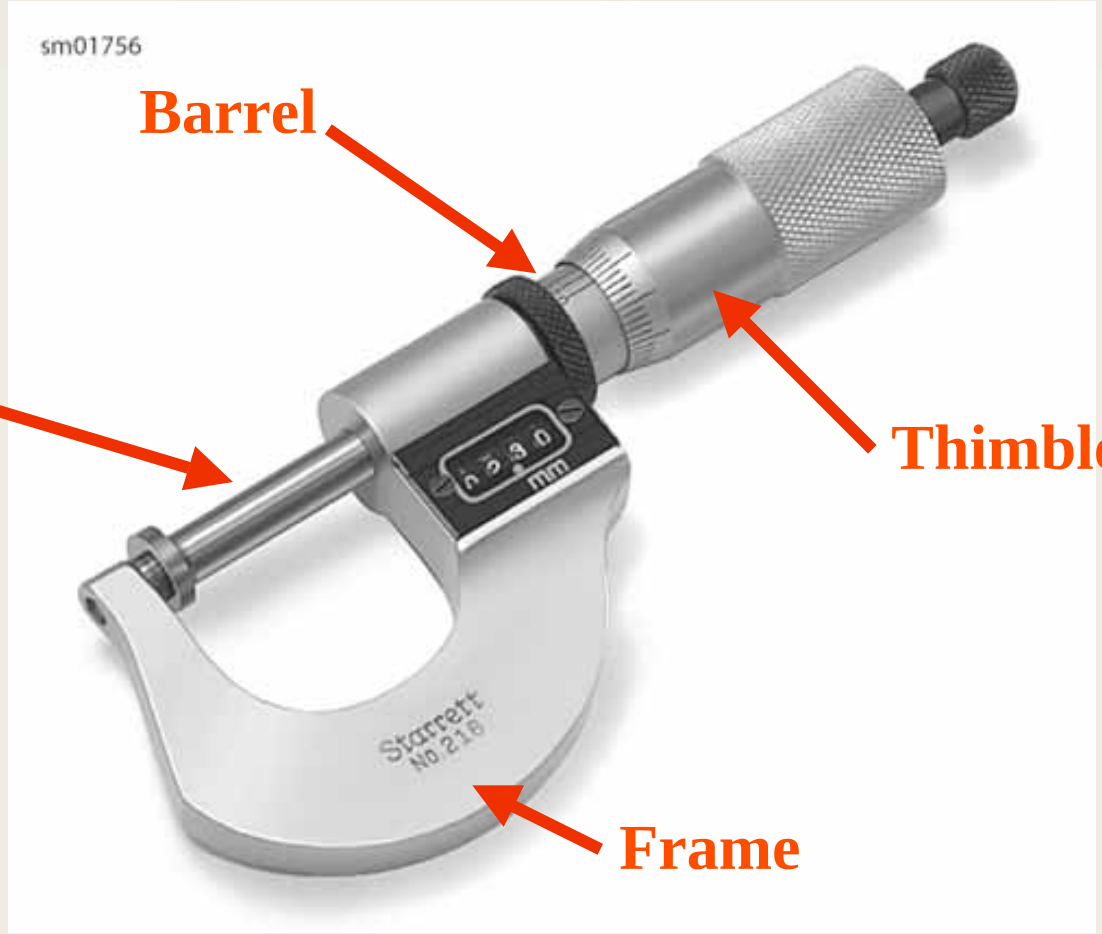
Removing Shim from Valve Collar



Shim and Bucket removed



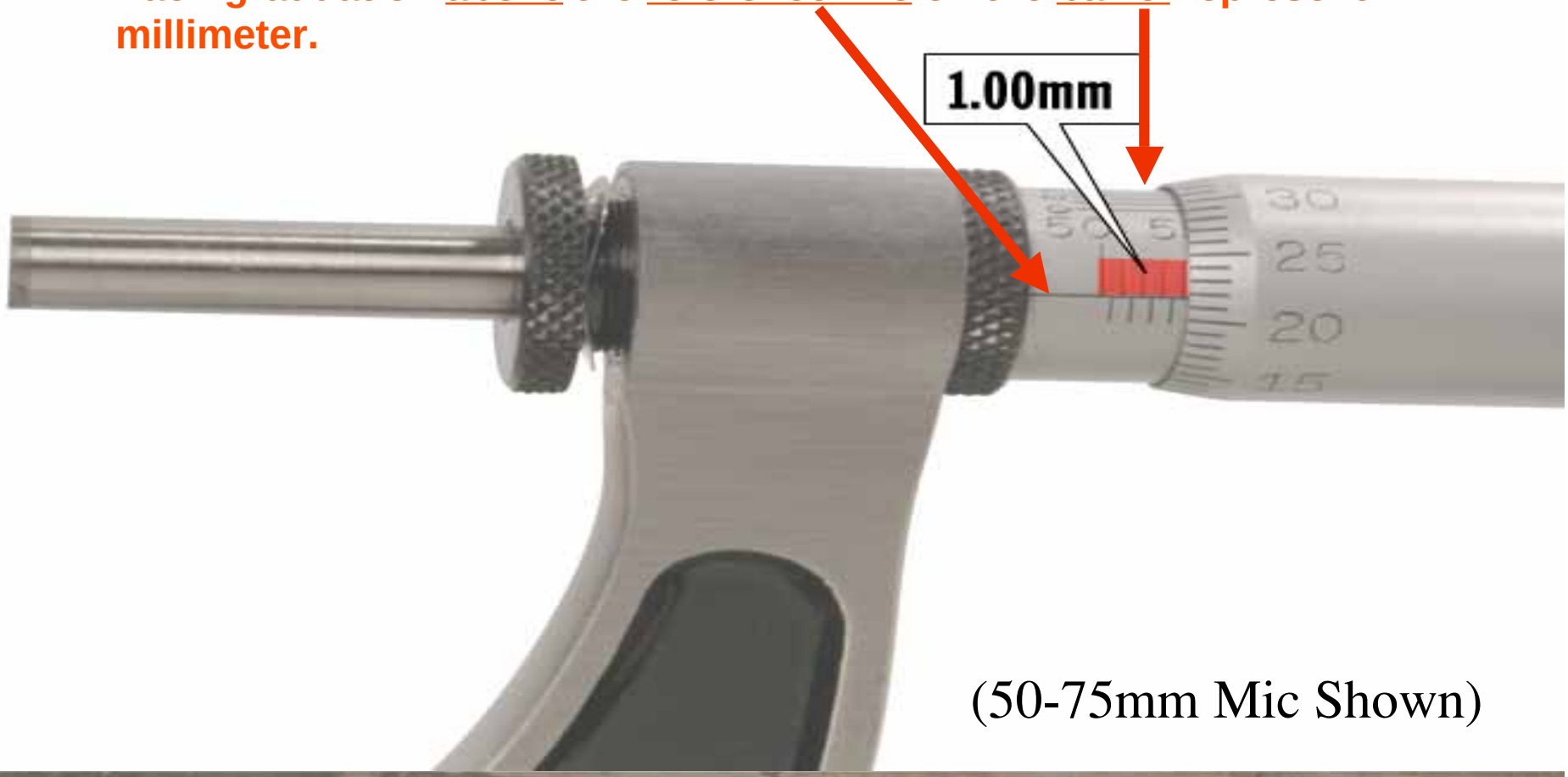
Metric Measuring Review



Metric Micrometer Set up and Reading

Reading a Metric Micrometer

- **Each graduation above the reference line on the barrel represent 1 millimeter.**



(50-75mm Mic Shown)

Reading a Metric Micrometer

Each graduation below the reference line on the barrel represents ½ a millimeter or .5 millimeter.

Reading a Metric Micrometer

Each graduation on the thimble represents .01 millimeters or 1/100th of a millimeter.

Reading a Metric Micrometer

- **Each graduation on the vernier scale represent .001 millimeters or 1/1000th of a millimeter.**

Vernier Scale

Reading a Metric Micrometer Recap
Example – Putting it into Practice

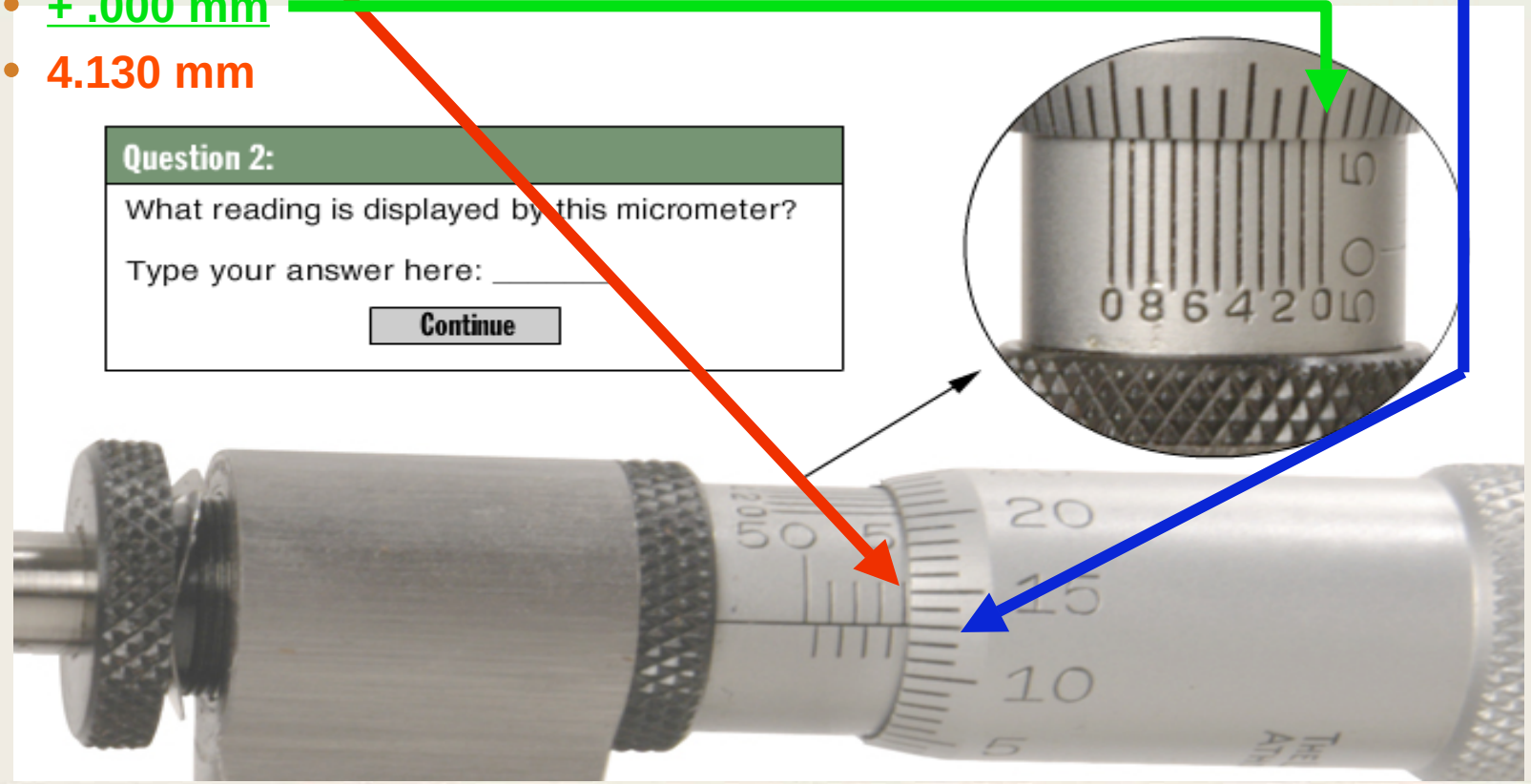
- 4.00 mm
- + .13 mm
- + .000 mm
- 4.130 mm

Question 2:

What reading is displayed by this micrometer?

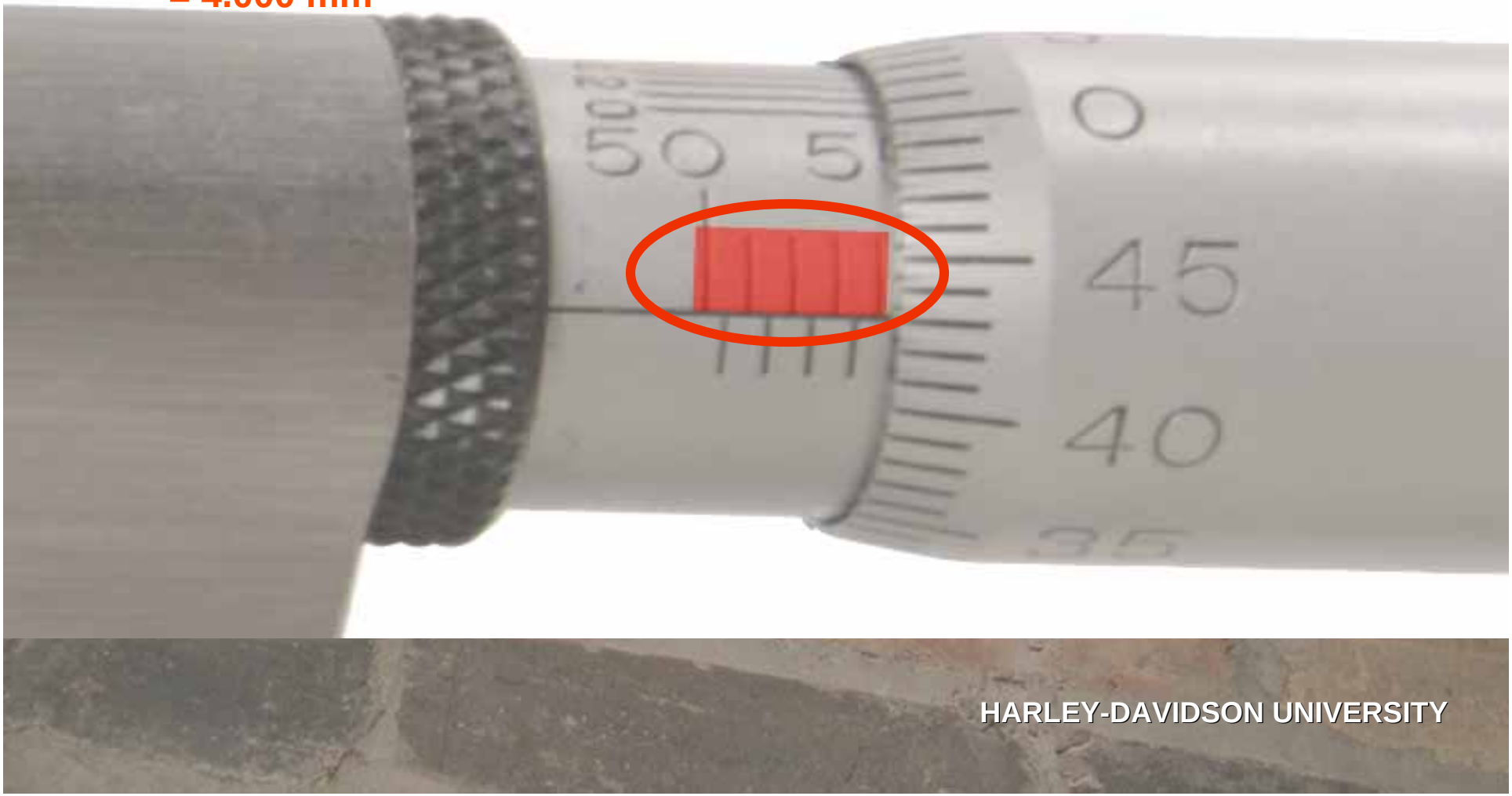
Type your answer here: _____

Continue



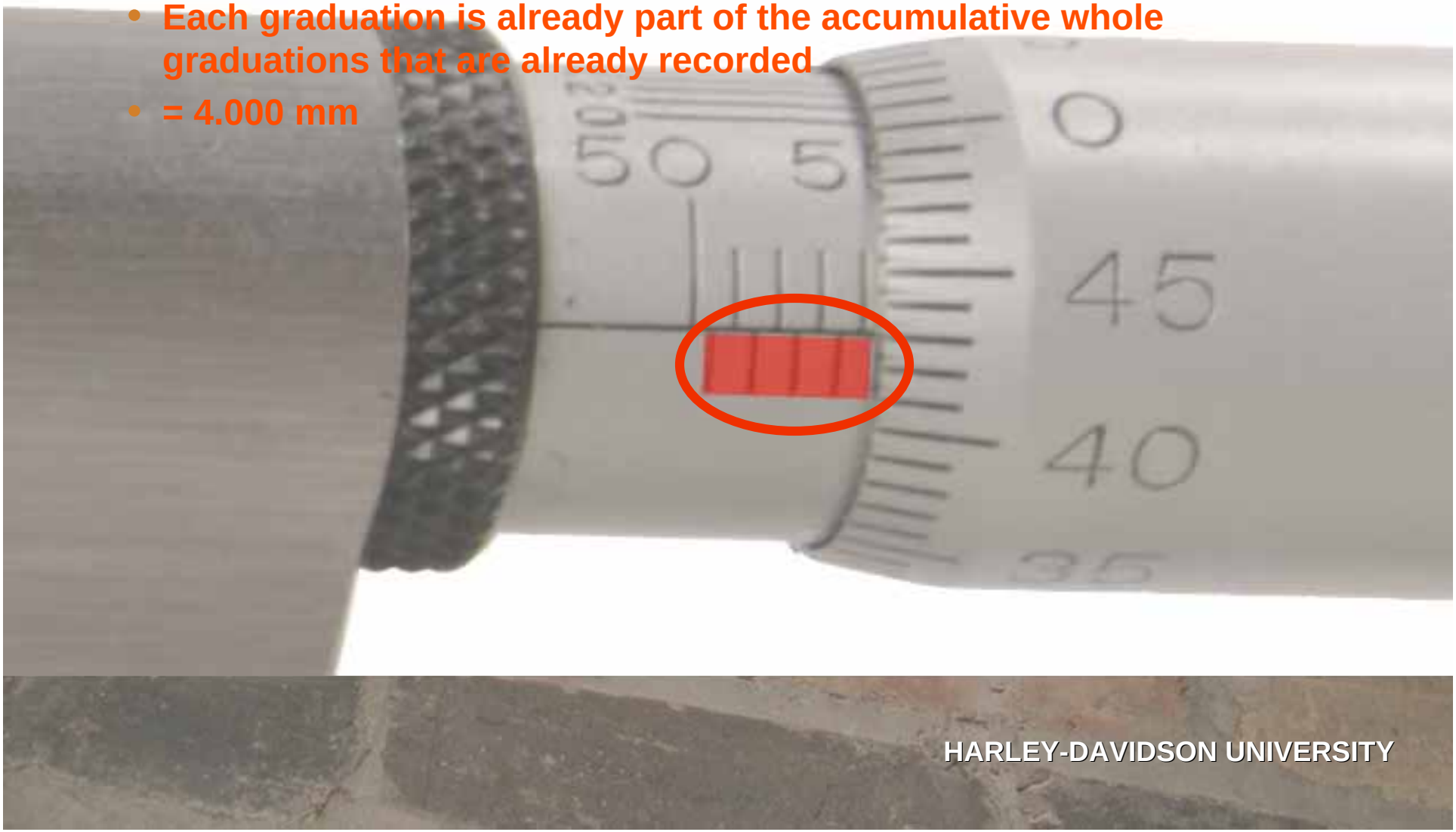
Metric Micrometer reading
Summary Review – Practice Example

- **4 whole millimeter graduations are shown – highlighted in RED above the reference line**
- **= 4.000 mm**



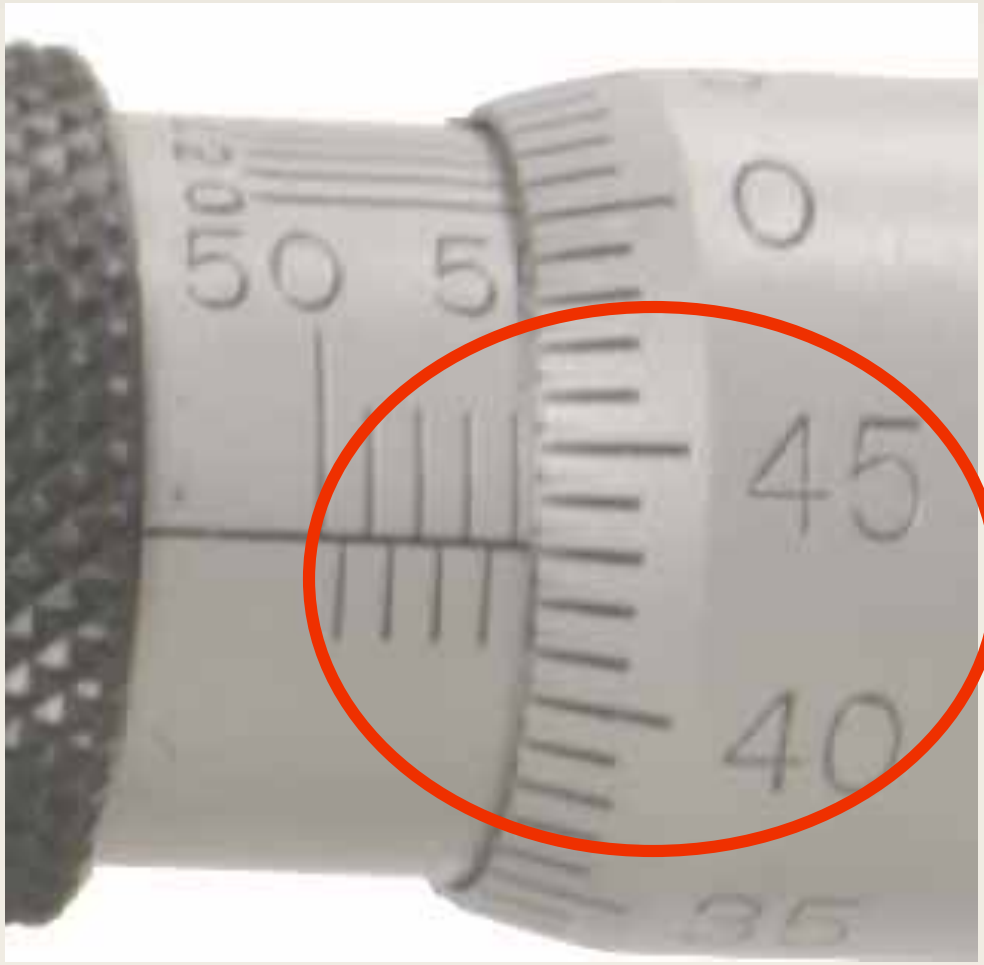
Metric Micrometer reading
Summary Review – Practice Example

- **4 half millimeter graduations are highlighted below in RED.**
- **Each graduation is already part of the accumulative whole graduations that are already recorded**
- **= 4.000 mm**



Metric Micrometer reading
Summary Review – Practice Example

- **Read the number represented on the Micrometer's Thimble (the portion of the Micrometer that turns)**
- **43 graduations are represented on the thimble**
- **.43 mm**



Metric Micrometer reading
Summary Review – Practice Example

- **Read the vernier scale**
- **The line represented by the 6 is lined up perfectly.**
- **The reading will now include .006 mm**
- **This will be the final digit of the measurement**

Metric Micrometer reading
Summary Review – Practice Example

- **The Final Reading**
- **Each incremental reading is added together for the final reading**
- **The metric micrometer reading is:**

4.000

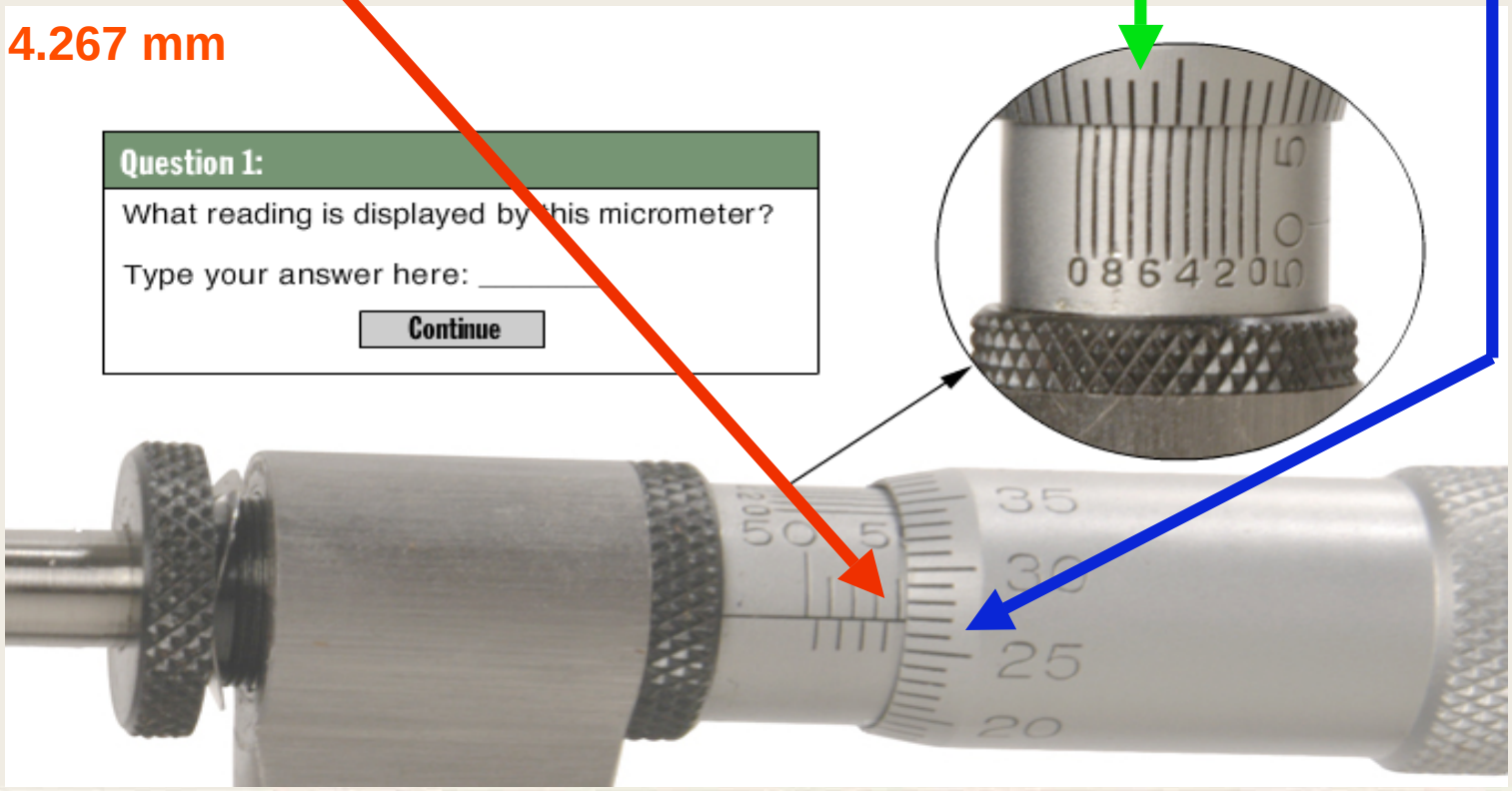
+ .43

+ .006

= 4.436 mm

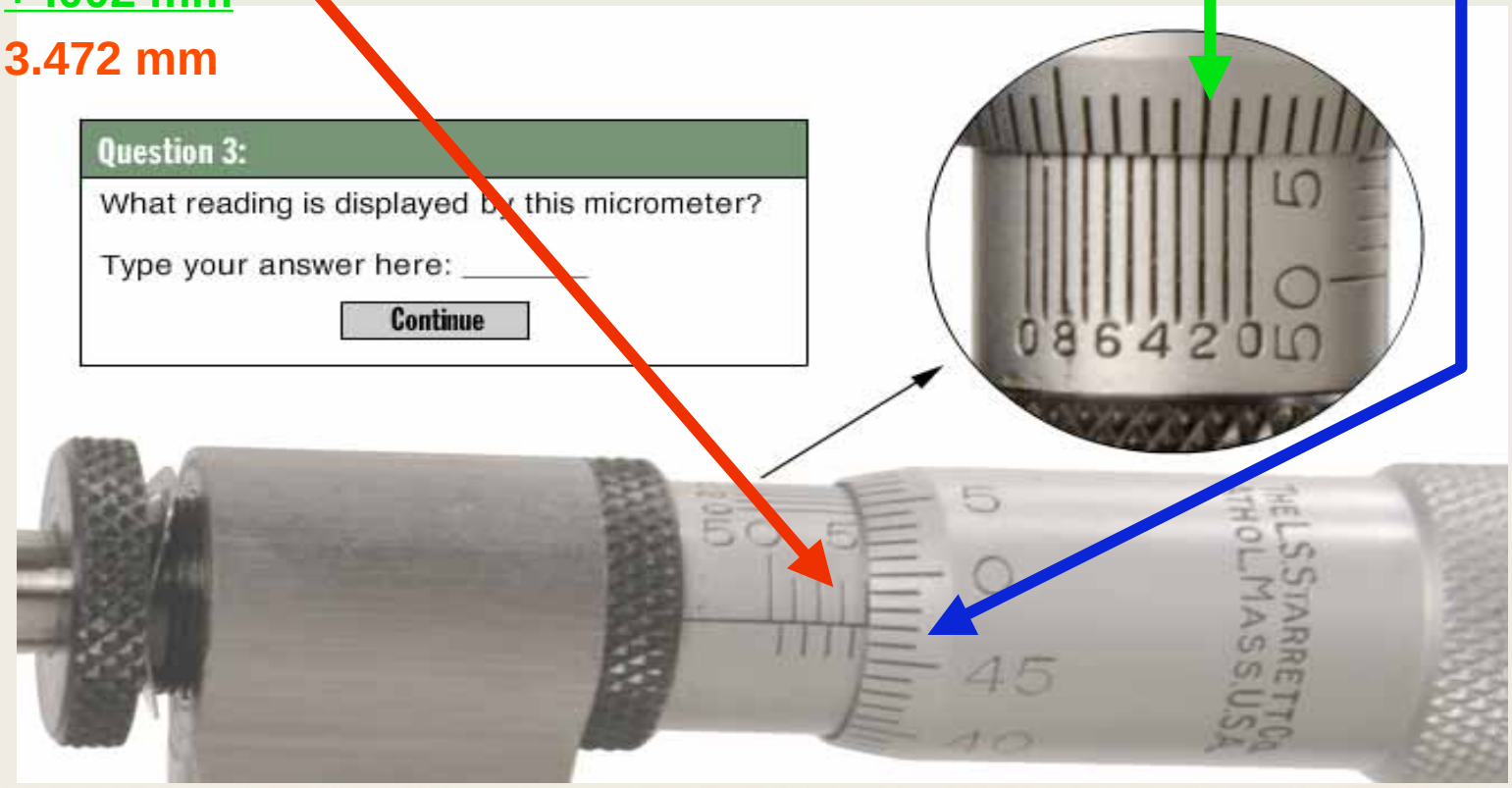
More Micrometer Examples
Summary Review

- 4.00 mm
- + .26 mm
- + .007 mm
- 4.267 mm



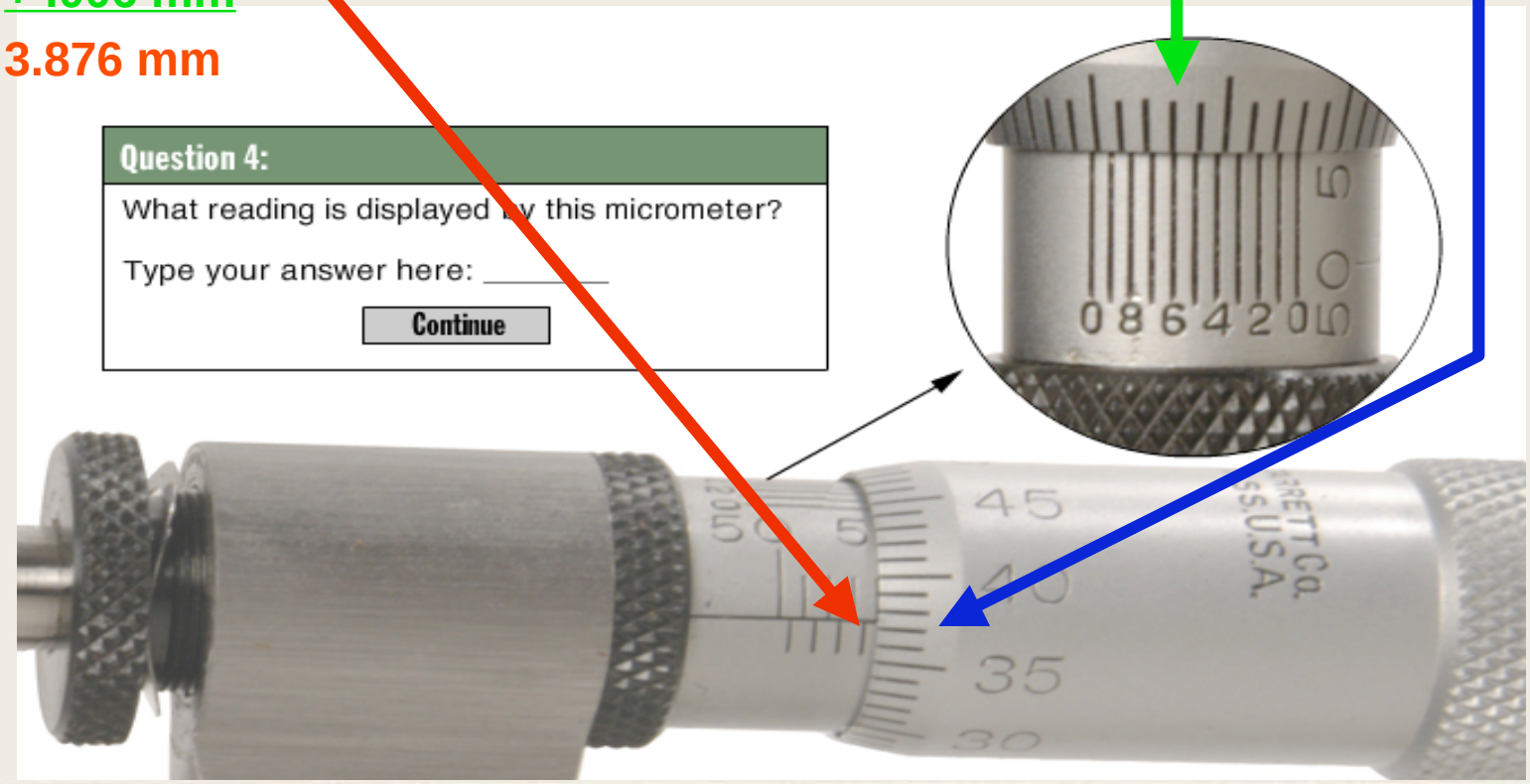
More Micrometer Examples
Summary Review

- 3.00 mm
- + .47 mm
- + .002 mm
- 3.472 mm



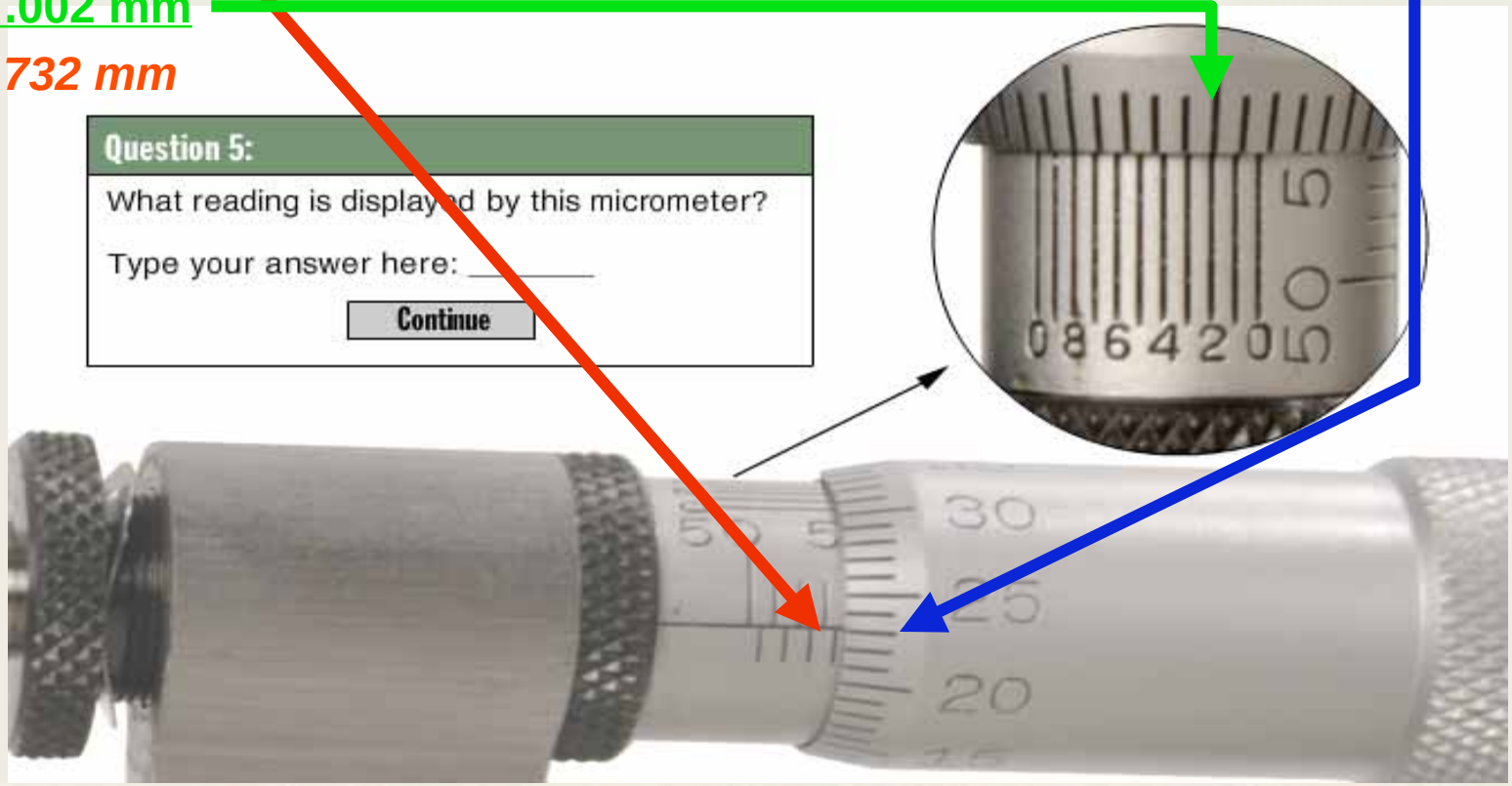
More Micrometer Examples
Summary Review

- 3.50 mm
- + .37 mm
- + .006 mm
- 3.876 mm



More Micrometer Examples
Summary Review Summary

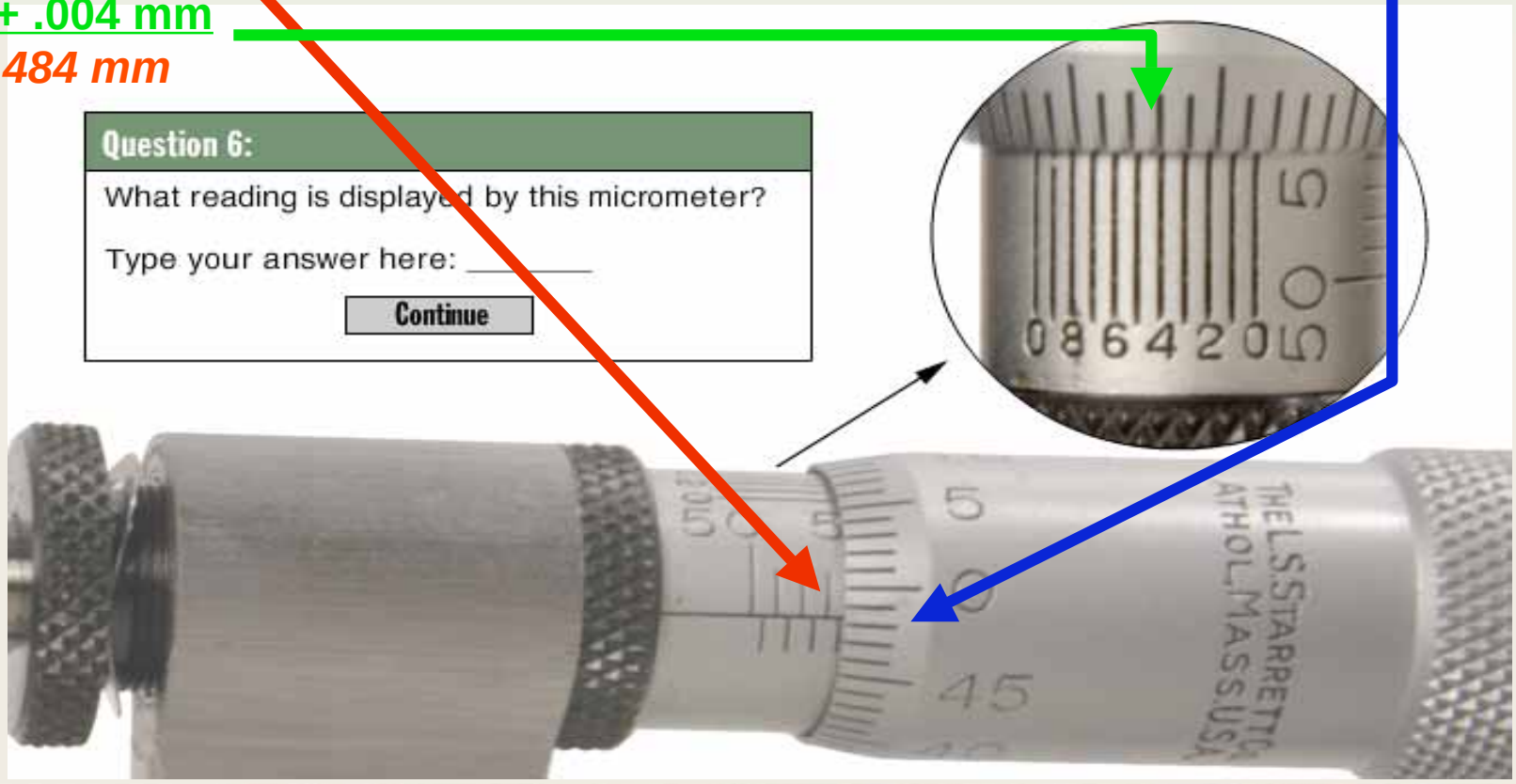
- **3.50 mm**
- **+ .24 mm**
- **+ .002 mm**
- ***3.732 mm***



More Micrometer Examples
Summary Review

- **3.00 mm**
- **+ .48 mm**
- **+ .004 mm**

3.484 mm



Measure all (4) Valve Shims
and record your measurement on your worksheet

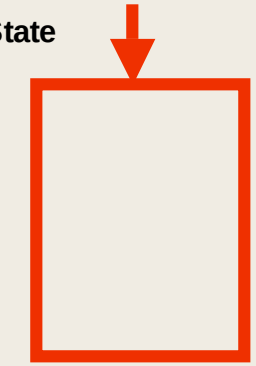
Record your Shim Measurements on the Worksheet

2009 HARLEY -DAVIDSON SKILLS USA COMPETITION VALVE LASH WORKSHEET

VRSC Front Cylinder

Record your shim measurements in the column below

Current State **Corrected State**



REMEMBER TO ALWAYS VARY TO THE SIDE OF THE UPPER LIMIT OF THE VALVE LASH RANGE A S LASH TENDS TO GO LOWER AS THE MILEAGE ON THE MOTORCYLE INCREASES.

With a shim under bucket design; to increase valve lash does a technician need to find a smaller or larger shim? _____

With a shim under bucket design; to decrease valve lash does a technician need to find a smaller or larger shim? _____

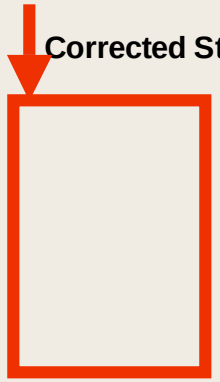
Record your Shim Measurements on the Worksheet

2009 HARLEY -DAVIDSON SKILLS USA COMPETITION VALVE LASH WORKSHEET

VRSC Front Cylinder

Record the NEW shim size that you have selected in the column below

Current State **Corrected State**

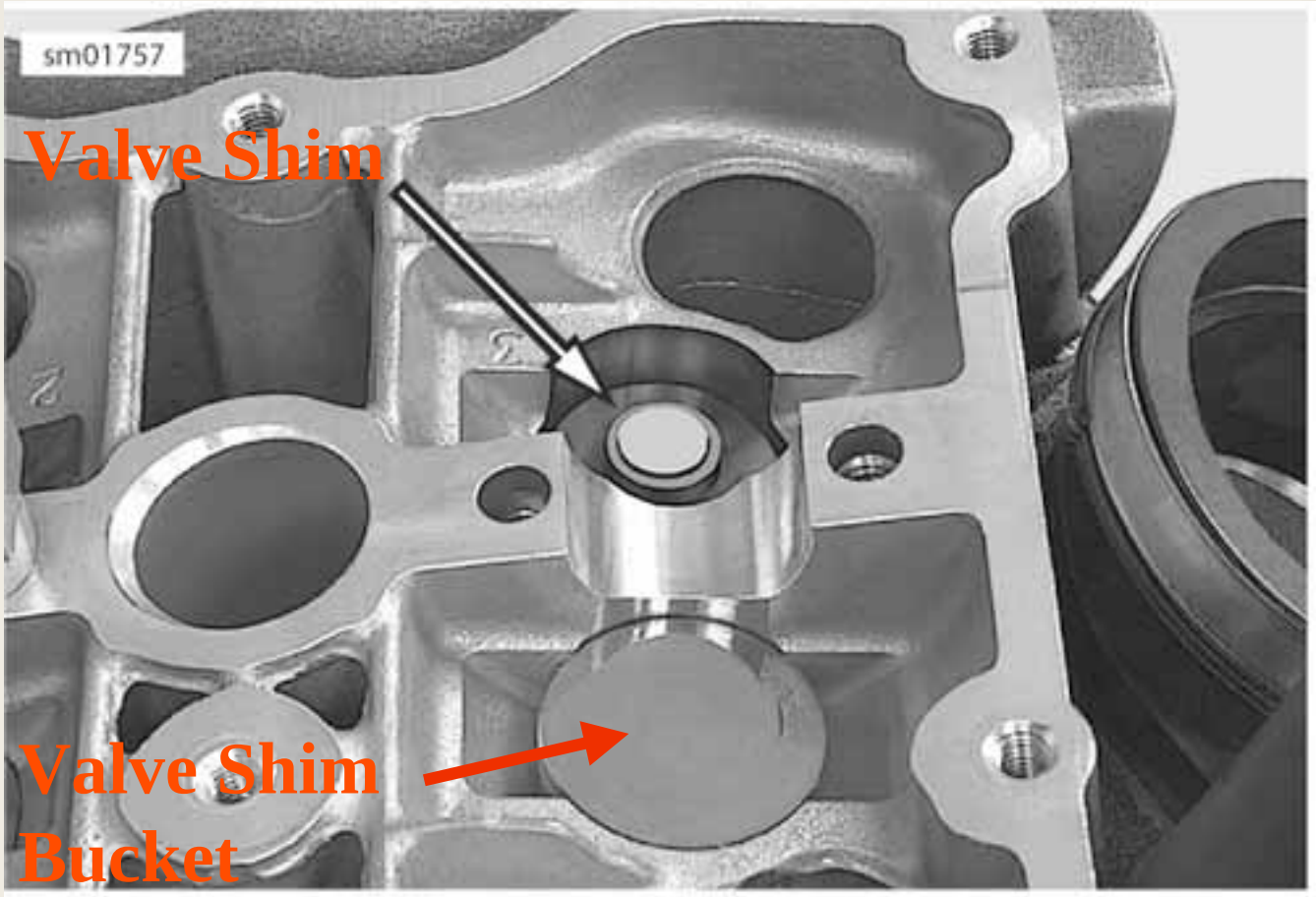


REMEMBER TO ALWAYS VARY TO THE SIDE OF THE UPPER LIMIT OF THE VALVE LASH RANGE A S LASH TENDS TO GO LOWER AS THE MILEAGE ON THE MOTORCYLE INCREASES.

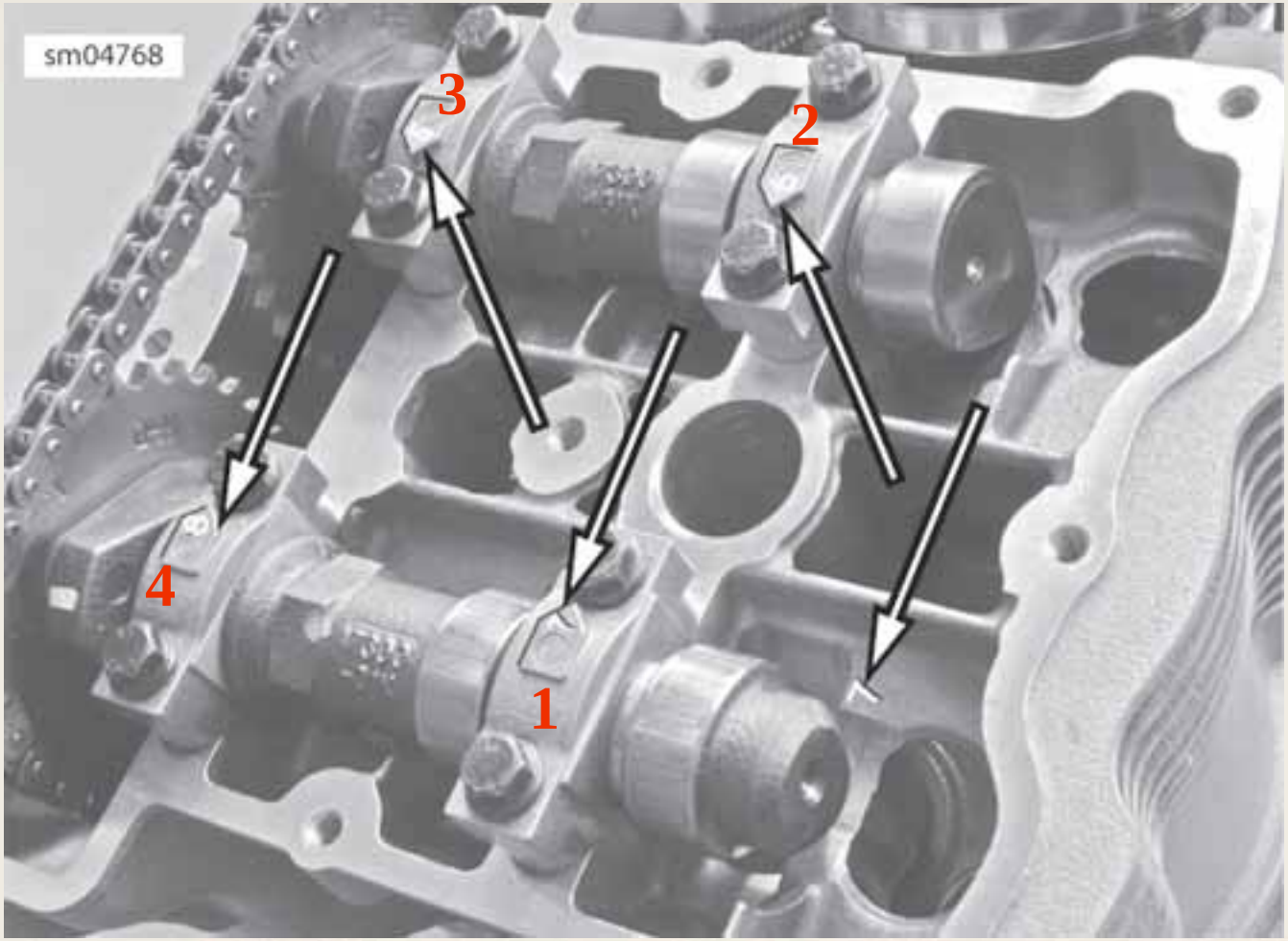
With a shim under bucket design; to increase valve lash does a technician need to find a smaller or larger shim? _____

With a shim under bucket design; to decrease valve lash does a technician need to find a smaller or larger shim? _____

Install the appropriate Shim on top of Valve Collar
Install Valve Shim Bucket over the Valve Spring



Re-install Camshafts and Journal Caps noting their location numbers and directional arrows



2009 Skills USA Championships

Motorcycle Service Technology Contest

Workstation #2

Electrical Troubleshooting

Sponsored by Yamaha Motor Corporation

2009 Skills USA Championships
Motorcycle Service Technology Contest

Workstation #2

Electrical Troubleshooting

Objective Information Sheet

Time Limit 30 Minutes

OBJECTIVE:

This workstation will enable the participant to demonstrate specific skills related to electrical circuit troubleshooting using a digital multimeter on a motorcycle.

SPECIFIC SKILLS:

The contestant will:

1. Properly use a service manual to identify electrical circuits/ components and find resistance specifications.
2. Properly measure voltage and resistance.
3. Evaluate the results of electrical tests to determine the cause of a failure.
4. Use the tools and equipment properly and safely.
5. Clean and reorganize the work area.

2009 Skills USA Championships
Motorcycle Service Technology Contest

Workstation #2

Electrical Troubleshooting

Instructions to Judge

Set-Up:

1. Verify that the multimeter is in proper working order.
2. Confirm that the motorcycle's battery is fully charged. Check its' voltage before the contestant begins.
3. Confirm all components/ wiring are properly connected prior to each contestant.

Inventory per Workstation (Four workstations):

Qty.	Description	Part Number	Furnished By
1	Yamaha WR250X Motorcycle		Yamaha
1	Snap On digital multimeter	MT145	Snap On
1	WR250X Service Manual		Yamaha

2009 Skills USA Championships
Motorcycle Service Technology Contest

Workstation #2

Electrical Troubleshooting

Contestant Worksheet

Contestant # _____

The owner of the Yamaha motorcycle in your work area reports the lights dim down and eventually he can't electric start it. If he charges up the battery, everything works ok for awhile.

Because we can't run the motorcycle in the contest area, assume the following:

a) Battery is ok
b) When the engine is run up to 5000rpm, the maximum voltage is 13.5.
c) There is only one problem on the bike.

1) Using the multimeter supplied, follow the troubleshooting steps in the service manual to check the electrical system. On the lines provided below, list each step you do and the results you found.

2) . List below the steps you follow in troubleshooting the circuit.

Step	Results
_____	
_____	
_____	
_____	
_____	
_____	
_____	
_____	
_____	
_____	
_____	
_____	
_____	
_____	
_____	
_____	
_____	
_____	

_____
_____
_____
_____

3. From the troubleshooting you have done, what circuit or component is not working
properly?

_____

Stop

6. Leave this worksheet and pencil with the judge.

2009 Skills USA Championships
Motorcycle Service Technology Contest

Workstation #2
Electrical Troubleshooting
Judge's Score Sheet

Contestant # _____ Start Time: _____
Judge's Initials: _____ Stop Time: _____
Total Time:
_____

Scoring Directions- *Utiless otherwise specified,* the performance of each skill should be "0", "1", "2" using the following criteria.

"0" indicates that the contestant **could not** perform this skill.
"1" indicates that the contestant **could partially** perform this skill.
"2" indicates that the contestant **could perform** the skill.

I. PERFORMANCE

2. Student found correct sections of manual
____ (0,6,12)

3. Steps followed to investigate problem.
Checked manual for charging system checks
____ (0,6,12)

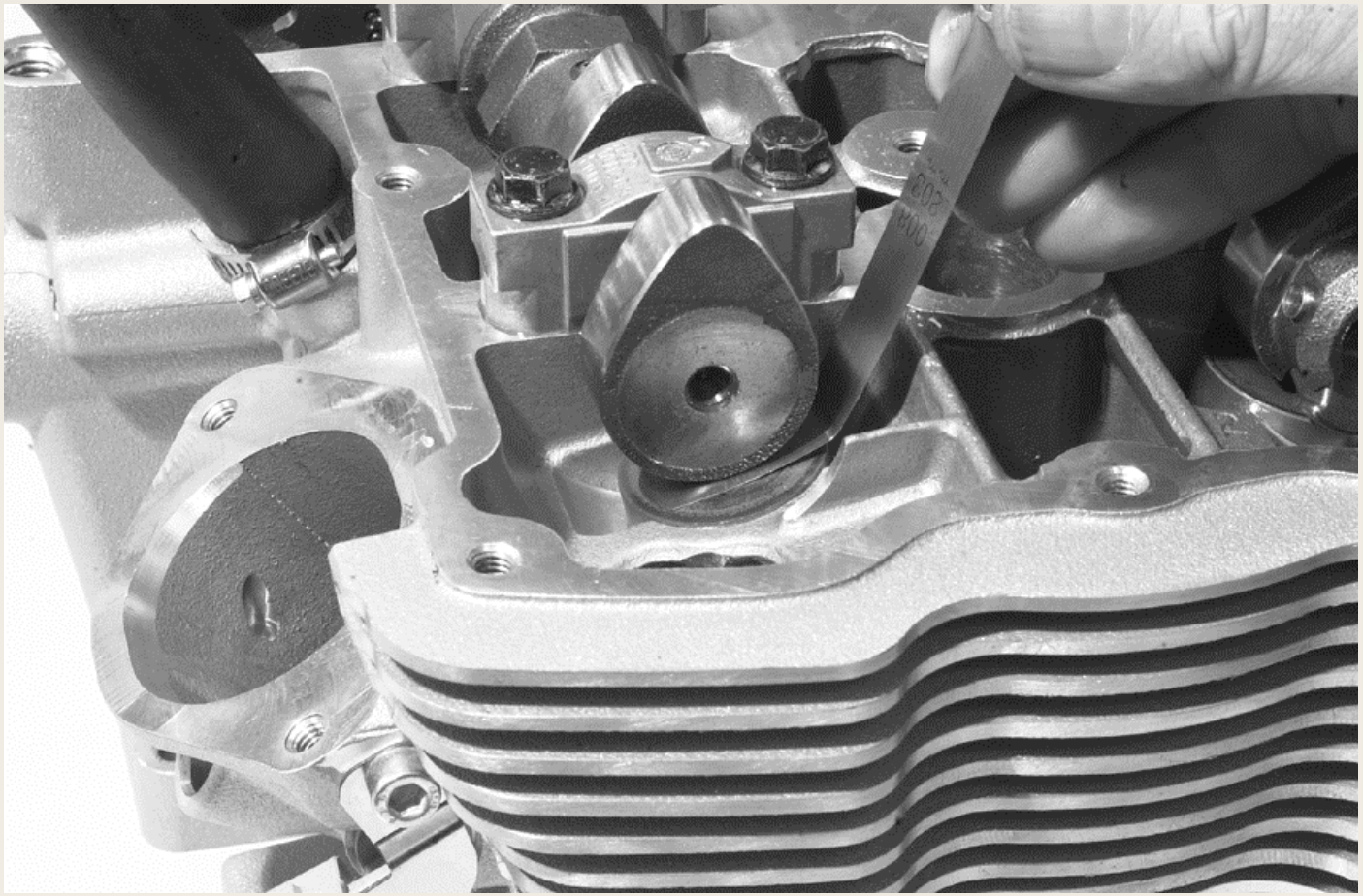
Checked fuse assembly
____ (0,6,12)
Checked battery voltage
_____ (0,6,12)
Checked stator resistance
____ (0,12,24)
Found stator has open wire
____ (0,12,24)

4. Found stator to be bad
_____ (0,15,30)

5. JOB SKILLS:
Used tools safely and properly.
_____ (0,6,12)
Cleaned and organized the work area.
_____ (0,6,12)

TOTAL POSSIBLE SCORE: 150 TOTAL
_____

Re-Checking Final Valve Lash – Corrected Measurement



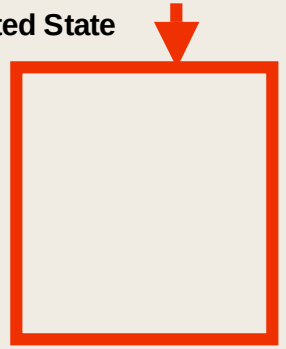
Record New Valve Lash Measurement

2009 HARLEY -DAVIDSON SKILLS USA COMPETITION VALVE LASH WORKSHEET

VRSC Front Cylinder

Record your Final Valve Lash Measurement here

Current State **Corrected State**



REMEMBER TO ALWAYS VARY TO THE SIDE OF THE UPPER LIMIT OF THE VALVE LASH RANGE A S LASH TENDS TO GO LOWER AS THE MILEAGE ON THE MOTORCYLE INCREASES.

With a shim under bucket design; to increase valve lash does a technician need to find a smaller or larger shim? _____

With a shim under bucket design; to decrease valve lash does a technician need to find a smaller or larger shim? _____

2009 SkillsUSA Championships

Motorcycle Service Technology Contest

Workstation # 3

Carburetor Inspection

Sponsored by Yamaha Motor Corporation

2009 SkillsUSA Championships
Motorcycle Service Technology Contest

Workstation # 3

Carburetor Inspection

Objective Information Sheet

Time Limit 30 Minutes

OBJECTIVE:

This workstation will enable the participant to demonstrate specific skills related to carburetor disassembly and inspection.

SPECIFIC SKILLS:

The contestant will:

1. Properly find the service manual section on carburetor circuits/ components.
2. Properly identify carburetor circuits/ components
3. Properly determine correct carburetor components and adjustments
4. Use the tools and equipment properly and safely.
5. Clean and reorganize the work area.

2009 SkillsUSA Championships
Motorcycle Service Technology Contest

Workstation # 3

Carburetor Inspection

Instructions to Judge

Set-Up:

1. Verify that the carburetor is ready for the contestant.
2. Confirm that the prior contestant hasn't changed any settings

Inventory per Workstation (Four workstations):

Qty.	Description	Part Number	Furnished By
1	Yamaha PW80 Motorcycle carburetor		Yamaha
1	Number 2 phillips screwdriver		Snap on
1	PW80 Service Manual		Yamaha
1	Metric calibrated small ruler		Snap on
1	Small flat blade screwdriver		Snap on

2009 SkillsUSA Championships
Motorcycle Service Technology Contest

Workstation # 3
Carburetor Inspection
Contestant Worksheet

Contestant # _____

On the table is a carburetor assembly for a Yamaha PW80 dirtbike. You will be asked to inspect this carburetor and answer questions about its function.

1a. Remove the float bowl from the assembly. Identify the main jet. What size main jet does it have? _____

1b. Is this the correct main jet for this model?
_____

1c. At what throttle position does the main jet have the most effect?

_____

2a. Identify the pilot jet. What size jet is in the assembly?
_____

2b. Is this the correct size for this carburetor?
_____

2c. As you look at the pilot jet, there are eight small holes in the jet body. If these holes were plugged, what effect would there be on the air/ fuel ratio?

_____
_____

3a. Identify the float assembly and measure the float height. What height do you find?
_____

3b. Is this the correct height?
_____

3c. If the float height was set at 10mm, what effect would this have on carburetor operation?

_____
_____

4a. Slide cutaway – What number slide cutaway does this carburetor have?

_____

4b. What is the stock cutaway number?
_____

4c. If the slide cutaway number is a higher number than stock, what effect would this have
on air/ fuel ratio?
_____

2009 SkillsUSA Championships
Motorcycle Service Technology Contest

Workstation # 3
Carburetor Inspection
Contestant Worksheet

5a. Jet needle – What is the jet needle number currently in this carburetor?
_____

5b. What is the correct number jet needle? _____

5c. What is the correct clip position? _____

6a. Pilot air screw setting – what is standard setting for this air screw?
_____

6b. If the air screw is turned out more than standard, what effect is there on air fuel ratio?

_____
_____

7a. Altitude adjustment – this carburetor is set from the factory for sea level. If the
carburetor needed to be reset for high attitude, would the main jet be a smaller number or

larger number?

_____

7b. At higher altitudes, what happens to the fuel air ratio if the carburetor is set for sea level?

_____

8a. In the float bowl, there is a hole that has a paint dot next to it. What is the purpose of this hole?

_____

8b. What effect would there be on carburetor function if it were plugged?

_____

9. Once finished, put the carburetor back together as you found it.

10. Please return the carburetor, manuals, etc in the position you found them.

Stop

11. Leave this worksheet and pencil with the judge.

2009 SkillsUSA Championships

Motorcycle Service Technology Contest

Workstation # 3

Carburetor Inspection

Judge's Score sheet

Contestant # _____ Start Time: _____

Judge's Initials: ____ Stop Time: _____

Total Time: _____

Scoring Directions- *Unless otherwise specified,* the performance of each skill should be "0", "3", "6" using the following criteria.

"0" indicates that the contestant **could not** perform this skill.

"3" indicates that the contestant **could partially** perform this skill.
"6" indicates that the contestant **could perform** the skill.

I. PERFORMANCE:

1a. Student identified the main jet size
____ (0,3,6)
1b. Student identified it as correct main jet
____ (0,3,6)
1c. Student identified main jet's main effect
____ (0,3,6)
2a. Student identified pilot jet size
____ (0,3,6)
2b. Identified correct size for this carb
____ (0,3,6)
2c. Identified emulsion holes and rich condition
____ (0,3,6)
3a. Correctly measured float height
____ (0,3,6)
3b. Correctly determined it is correct height
____ (0,3,6)
3c. Identified that carb would run rich/ overflow
____ (0,3,6)
4a. Identified slide cutaway number
____ (0,3,6)
4b. Identified stock cutaway number for this model
____ (0,3,6)
4c. Identified that a higher cutaway number leans the fuel mixture
____ (0,3,6)
5a. Identified the needle currently in the carb
____ (0,3,6)
5b. Identified the correct needle size for this carb
____ (0,3,6)
5c. Identified correct clip position
____ (0,3,6)
6a. Identified correct standard screw position
____ (0,3,6)
6b. Identified that mixture is leaner with more turns out
____ (0,3,6)
7a. Identified that a smaller main jet would be used at altitude
____ (0,3,6)
7b. Identified that the air/fuel ratio would be richer at higher altitude
____ (0,3,6)
8a. Identified the float bowl hole as for the choke circuit
____ (0,3,6)
8b. Identified that the choke wouldn't work if the hole is plugged
____ (0,3,6)
9. Carburetor correctly reassembled
____ (0,3,6)

10. Materials put in their correct places ____ (0,3,6)

II. JOB SKILLS:

Used tools safely and properly.
____ (0,3,6)

Cleaned and organized the work area.
____ (0,3,6)

TOTAL POSSIBLE SCORE: 150 TOTAL ______

2009 SkillsUSA Championships

Motorcycle Service Technology Contest

Workstation 4

Buell
Dynamic Digital Fuel Injection (DDFI)
Component Identification and Function

Sponsored by Buell Motorcycle Company

SkillsUSA
2009 Motorcycle Service Technology Contest
Workstation 4
Buell DDFI Component I.D. & Function

Objective Information Sheet

Time Limit 30 Minutes

OBJECTIVE:

Given a Buell Dynamic Digital Fuel Injection (DDFI) simulator board, and Buell Service Manual, participants will correctly identify the system components and function as listed and described in the service manual.

SPECIFIC SKILLS:

The contestant will:

1. Locate the DDFI components in the service manual.
2. Correctly identify the components on the simulator board.
3. Correctly answer the questions pertaining to the components on the worksheet.
4. Clean and reorganize the work area.

SkillsUSA
2009 Motorcycle Service Technology Contest
Workstation 4
Buell DDFI Component I.D. & Function
Instructions to Judge

Set-Up:

1. The DDFI Simulator Board and service manual should be organized on the worktable.
2. DDFI Simulator Board should be plugged in and checked for operation.

Inventory per Workstation (four workstations):

Qty.	Description	Part Number	Furnished by
1	2004 Buell Lightning Service Manual	99490-06Y	H-D
1	Buell DDFI Simulator Board		H-D
1	Extension cord		H-D

SkillsUSA
2009 Motorcycle Service Technology Contest
Workstation 4
Buell DDFI Component I.D. & Function
Contestant Worksheet

Contestant # _____

1. Using the service manual identify the "numbered" components on the DDFI Simulator Board and record your answer next to the corresponding number listed below.

#1 _____

#2 _____

#3 _____

#4 _____

#5 _____

#6 _____

#7 _____

#8 _____

#9 _____

2. Using the Service Manual identify the "lettered" Fuel Pump components on the DDFI simulator board and record your answers next to the corresponding letter listed below.

A. _____

B. _____

C._____

Using the service manual answer the following questions.

3. The DDFI System uses _____ (number of) sensors to monitor the operating conditions of the engine.

SkillsUSA
2009 Motorcycle Service Technology Contest
Workstation 4
Buell DDFI Component I.D. & Function

4. During closed loop operation the system relies on input from the _____ sensor to provide the most efficient, stoichiometric air fuel mixture which results in reduced emissions, good fuel economy and power.

5. The _____ and _____ sensors are thermistor devices which means that at a specific temperatures they will have a specific resistance across their terminals. As the resistance varies so does the voltage supplied.

6. The _____ sensor monitors the oxygen content in the exhaust gas and converts it to a voltage reading.

7. The _____sensor measures the air temperature allowing the ECM to calculate the density of the air entering the manifold.

STOP: Leave this worksheet and pencil with the judge.

SkillsUSA
2009 Motorcycle Service Technology Contest
Workstation 4
Buell DDFI Component I.D. & Function
Judge's Scoresheet

Contestant #_____ Start Time:_____

Judge's Initials:_____ Stop Time:_____

Scoring Directions: Unless otherwise specified, the performance of each contestant should be "0", or "5" or for the questions 3 – 7 and job skills "0", "4", or "8". using the following criteria:

"0" indicates the contestants answer is incorrect.
"4" indicates the contestants answer is partially correct. (Where applicable)
"5" or "8" indicates the contestants answer is correct.

I. PERFORMANCE:

1. Using the service manual identify the numbered components on the DDFI Simulator Board and record your answer next to the corresponding number listed below.

#1 Electronic Control Module (ECM) pg. 4-3 lists all components
___(0, 5)

#2 Cam Position Sensor & Rotor (CMP)
___(0, 5)

#3 Oxygen Sensor (02)
___(0, 5)

#4 Engine Temperature Sensor (ET)
___(0, 5)

#5 Bank Angle Sensor (BAS)
___(0, 5)

#6 Intake Air Temperature Sensor (IAT)
___(0, 5)

#7 Throttle Position Sensor (TP)
___(0, 5)

#8 Fuel Pump
___(0, 5)

#9 Throttle Body
___(0, 5)

SkillsUSA
2009 Motorcycle Service Technology Contest
Workstation 4

Buell DDFI Component I.D. & Function

2. Using the Service Manual identify the lettered Fuel Pump Components on the DDFI simulator board and record your answers next to the corresponding letter listed below. (pg. 4-110)

A. Fuel Screen ___(0, 5)

B. Low Fuel Level Sensor ___(0, 5)

C. Pressure Regulator ___(0, 5)

SkillsUSA
2009 Motorcycle Service Technology Contest
Workstation 4
Buell DDFI Component I.D. & Function

Using the service manual answer the following questions.

3. The DDFI System uses 6 (pg. 4-3) (number of) sensors to monitor the operating conditions of the engine.
___(0, 4, 8)

4. During closed loop operation the system relies on input from the 02 (pg. 4-3) ___ sensor. ___(0, 4, 8)

5. The ET (pg. 4-52) and IAT (pg. 4-56) sensors are thermistor devices, which means that at a specific temperature they will have a specific resistance across its terminals. As the resistance varies so does the voltage supplied.
___(0, 4, 8)

6. The 02 (pg. 4-47 or 4-101) sensor monitors the oxygen content in the exhaust gas and converts it to a voltage reading.

___(0, 1, 2)

7. The IAT (pg. 4-105) sensor measures the air temperature allowing the ECM to calculate the density of the air entering the manifold.
___(0, 4, 8)

II. JOB SKILLS:

1) Cleaned and organized the work area
_(0, 4, 8)

Total Possible Score 100
_____

2009 SkillsUSA Championships

Motorcycle Service Technology Contest

Workstation 5

Buell
Digital Technician II Diagnostics

Sponsored by Buell Motorcycle Company

SkillsUSA
2009 Motorcycle Service Technology Contest
Workstation 5
Digital Technician II Diagnostics

Objective Information Sheet

Time Limit 30 Minutes

OBJECTIVE:

Given the tools, motorcycle, and Instruction Sheet, participants will correctly test and record vehicle data on a 08 Buell 1125R motorcycle.

SPECIFIC SKILLS:

The contestant will:

1. Follow the instructions outlined in the supplied test booklet to correctly test and record the requested vehicle data using the Digital Technician II diagnostic computer.
2. Use a digital multimeter to properly measure voltage for the requested battery data.
3. Evaluate multimeter test results to determine component state or condition.
4. Use the tools and equipment properly and safely.
5. Clean and reorganize the work area.

SkillsUSA
2009 Motorcycle Service Technology Contest
Workstation 5
Digital Technician II Diagnostics
Instructions to Judge

Set-Up:

1. The instruction manual, and tools should be organized on the table.
2. The judge should monitor the participant's progress to ensure safe use of the equipment.
3. Verify the DVOM is functioning properly.
4. Verify the vehicle battery is fully charged.
5. The contestant should turn "off" the DVOM, unhook the leads and properly prepare them for the next participant.
6. If the contestant does not finish the prescribed work, in the time allotted, the judge must set-up for the next contestant.

Inventory per Workstation (four workstations):

Qty.	Description	Part Number	Furnished by
1	Test booklet		H-D
1	Battery Tender (Global Battery Charger)	94654-98	H-D
1	Test Leads and clips		H-D
1	Extension Cord for battery tender (if needed)		H-D
1	Fluke 789 Processmeter DVOM		H-D
1	Digital Technician II computer and power cord		H-D
1	Techlink II	HD-48650-1	H-D
1	USB Cord (Techlink II to USB Computer Port)		H-D
1	Fluke Optical Cord (Meter to USB Port on Computer		H-D
1	Flashlight		H-D

SkillsUSA
2009 Motorcycle Service Technology Contest
Workstation 5
Digital Technician II Diagnostics

Contestant Worksheet

Contestant # _____

Using the test booklet and the Digital Technician II computer, record the following data below.

1) VIN _____

2) Vehicle Mileage _____

3) Active and / or Historic Fault Code Numbers.
_____

4) Idle Air Control Steps. _____

5) Fuel Pressure. _____

6) Battery Voltage. _____

These answers from page 8 in your test booklet

7) Engine Coolant Temperature. _____

8) Intake Air Temperature Sensor Degrees. _____

9) Barometric Pressure In. HG. _____

10) Throttle Position Degrees at Closed Throttle. _____

11) Throttle Position Degrees at Wide Open Throttle. _____

12) Clutch Switch Input w/clutch lever out. _____

13) Clutch Switch Input w/clutch lever compressed to handlebar.
_____

14)(From page 10 in Test Booklet) Existing Battery Voltage _____

15)Minimum Battery Voltage after cranking starter motor for 5 Seconds. _____

16)Maximum Battery Voltage after cranking starter motor for 5 Seconds. _____

17)Fuel Pressure after disconnecting fuel pump connecter and cranking starter motor.
_____

18)Fuel Pressure after reconnecting fuel pump connector and energizing fuel pump.
_____

STOP: Leave this worksheet and pencil with the judge.

SkillsUSA
2009 Motorcycle Service Technology Contest
Workstation 5
Digital Technician II Diagnostics

Organize your work area to prepare for the next contestant.

SkillsUSA
2009 Motorcycle Service Technology Contest
Workstation 5
Digital Technician II Diagnostics
Judge's Scoresheet

Contestant #_____

Start Time:_____

Stop Time:_____

Judge's Initials:_____

Scoring Directions: **Unless otherwise specified**, the performance of each skill should be "0", "3", or "10", using the following criteria:

"0" indicates the contestant ***could not or did not*** perform this skill. Nothing has been recorded for that answer or an incorrect value such as Throttle Position **Percent** rather than the requested **Degrees**.
"3" is awarded if the value is generally correct, but a decimal point may be in the wrong spot.
"10" indicates the contestant ***could*** perform this skill.

I. PERFORMANCE:

Using the instruction booklet, record the following data below.
POINTS

1) Entered VIN correctly _____ (0,3,10)
1) _____

2) Vehicle mileage entered correctly _____ (0,3,10) 2) _____

3) Active and/or Historic Code Numbers P110, (possibly P0628, P0087) (0,3,10) 3) _____

4) Idle Air Control Steps. ___Approx. 144_____ 0,3,10) 4) _____

5) Fuel Pressure. __73-74 PSI_____ (0,3,10)
5) _____

6) Battery Voltage. _11.9 – 12.5 V_____ (0,3,10) 6) _____

7) Engine Coolant Temperature. _Ambient Temperature_ (0,3,10) 7) _____

8) Intake Air Temperature Sensor Degrees. _Ambient Temperature (0,3,10) 8) _____

9) Barometric Pressure HG. _Approx. 28.5 In. HG (current reading from data screen) (0,3,10) 9) _____

10) Throttle Position Degrees at Closed Throttle. _Approx. 2.2 Degrees (0,3,10) 10) _____

11) Throttle Position Degrees at Wide Open Throttle. _Approx 85 Degrees (0,3,10) 11) _____

12) Clutch Switch Input w/clutch lever out. __Released_ (0,10) 12) _____

SkillsUSA
2009 Motorcycle Service Technology Contest
Workstation 5
Digital Technician II Diagnostics

13)Clutch Switch Input w/clutch lever compressed to handlebar. Pulled In (0,10)
13) _____

14)Existing Battery Voltage __11.9 – 12.5 V___
(0,3,10)14) _____

15)Min. Bat. V. after cranking starter motor for 5 sec.. _Approx. 9.5 - 10.8 V.
(0,3,10) 15)_____

16)Max. Bat. V. after cranking starter motor for 5 sec. (Approx. Bat.V.)
(0,3,10) 16) _____

17)Fuel Pressure after disconnecting fuel pump connecter and cranking starter. 0 PSI
(0,3,10) 17) _____

18)Fuel Pressure after reconnecting fuel pump connector and energizing pump. 73-74 PSI(0,3,10)18) _____

19)Properly cleaned their work area and shut off the ignition switch.
(0,3,10)19) _____

20) Properly disconnected fuel pump connector with no potential damage. (0,3, 10) 20) _____

Total Possible Score 200 Total Points _____

Buell **1125R** Engine Diagnostics

- **READ AND FOLLOW THESE INSTRUCTIONS CAREFULLY AND DON'T MISS A STEP**

- IF THERE IS A COMPUTER GLITCH, NOTIFY YOUR JUDGE AND HE OR SHE WILL CORRECT IT AND, IF NECESSARY, ADD APPROPRIATE TIME AT THE END OF YOUR SESSION

- THESE COMPUTER SCREENS ARE TOUCH-SENSITIVE AND THE SUPPLIED 'TOUCH-PEN' CAN BE USED FOR SELECTING ICONS RATHER THAN THE MOUSE PAD AND BUTTONS. IT'S YOUR CHOICE.

Buell **1125R** Engine Diagnostics

- Welcome to the Digital Technician II motorcycle diagnostics tool. Follow these directions carefully and you will be rewarded with an enjoyable and informative sample of motorcycle computer aided diagnostics.
- Your first step is to select the RUN position of the motorcycle Run/Stop switch and then turn the ignition key to the ON position to establish communication between the motorcycle and the Digital Technician II computer.

From the Digital Technician (DT) home screen, select (<u>single</u> click or tap) the upper left-hand icon. (Vehicle Select)

Pausing the cursor arrow over any button icon will cause a brief description of that button to pop-up.

Carefully type in the Vehicle Identification number (VIN).

The VIN is located on the forward right-side of the frame right behind the steering neck

NOTE: All Os in the VIN are **numbers**, not letters

Use the provided flashlight if necessary to read the VIN

Click in the circled ODOMETER box and enter the vehicle mileage displayed on the motorcycle instrument cluster.

Next, click on the circled check box.

Click the circled TOOLBOX icon

This is the screen you will see. It lists any current or historic fault codes for the vehicle. **Record** these, if any, fault codes on your work sheet.

Next, click on the circled DATA ITEMS icon.

Record on your test sheet from the VALUE and UNITS column, the requested items for questions 4-13.

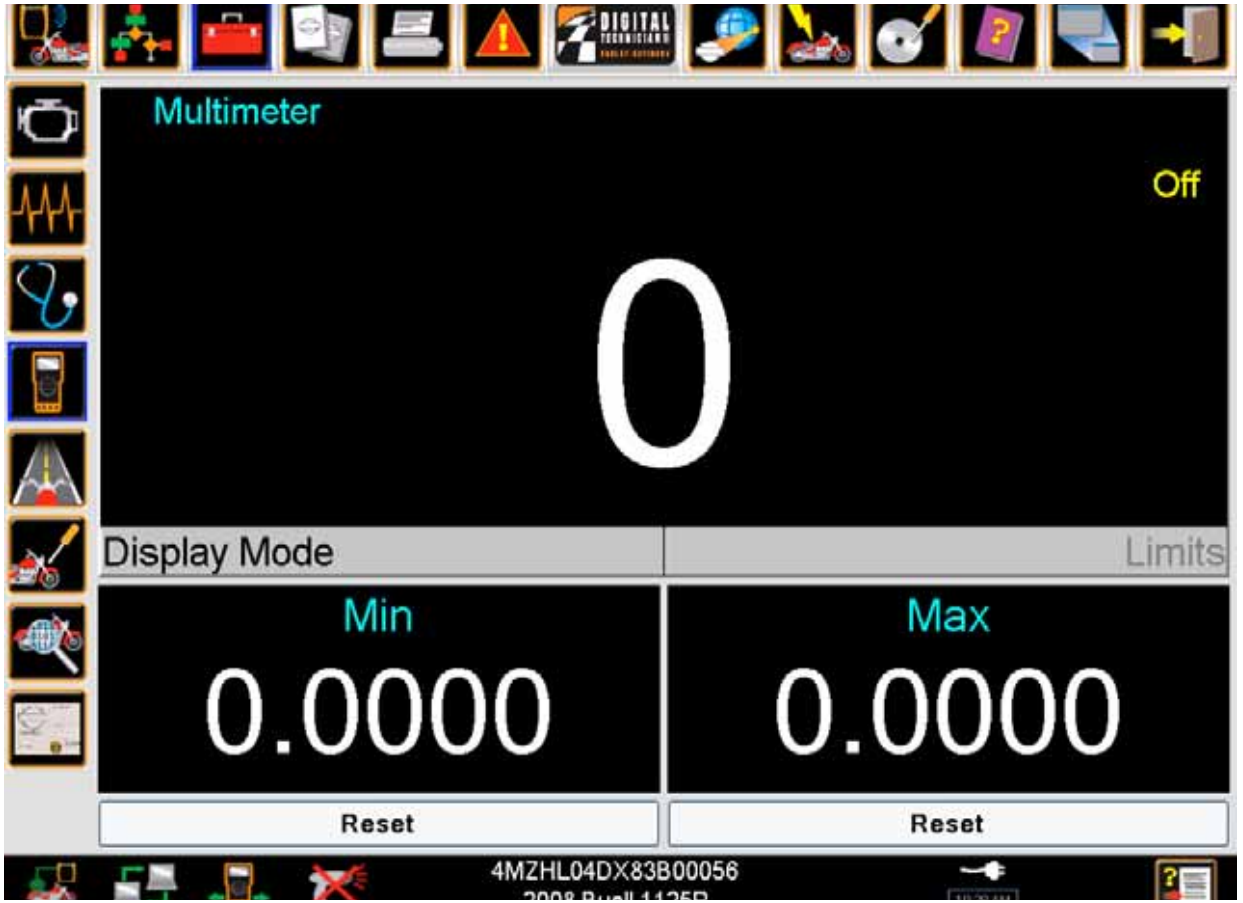
Additional values can be viewed by using the scroll bar on the right side of the data screen.

Click on the circled MULTIMETER icon

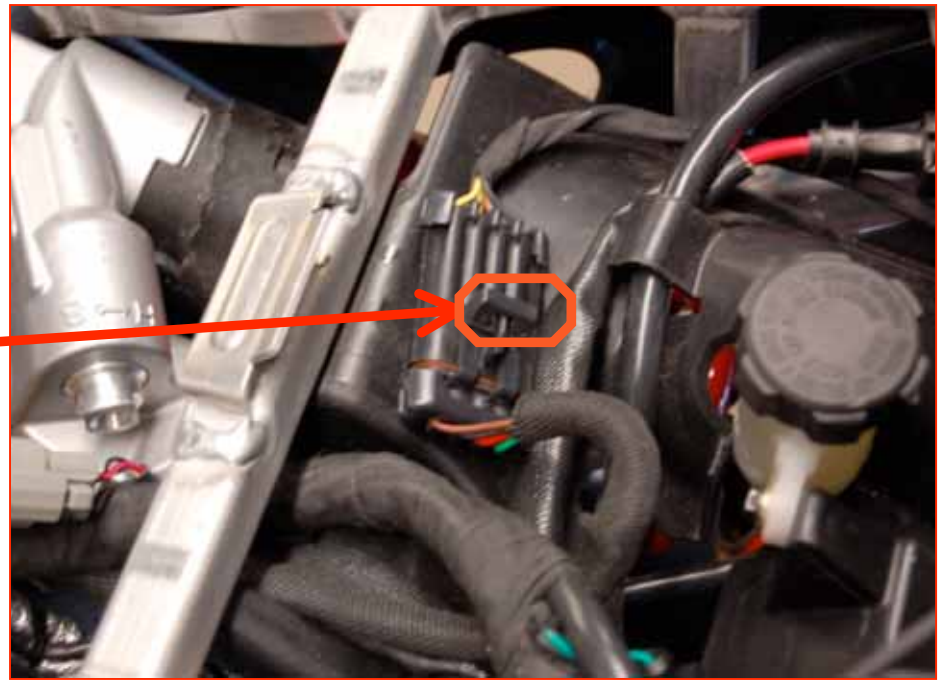
This is what you should see.

Next, attach the supplied multimeter leads to the meter and to the motorcycle battery terminals.

Turn the meter dial to the appropriate selection and record the existing battery voltage.



Carefully lift the locking tab on the fuel pump connector and disconnect the four-wire connection to disable the fuel pump.



Do Not pull on the actual wires as it will damage the connector

Select or touch both RESET buttons in the Min and Max screens.

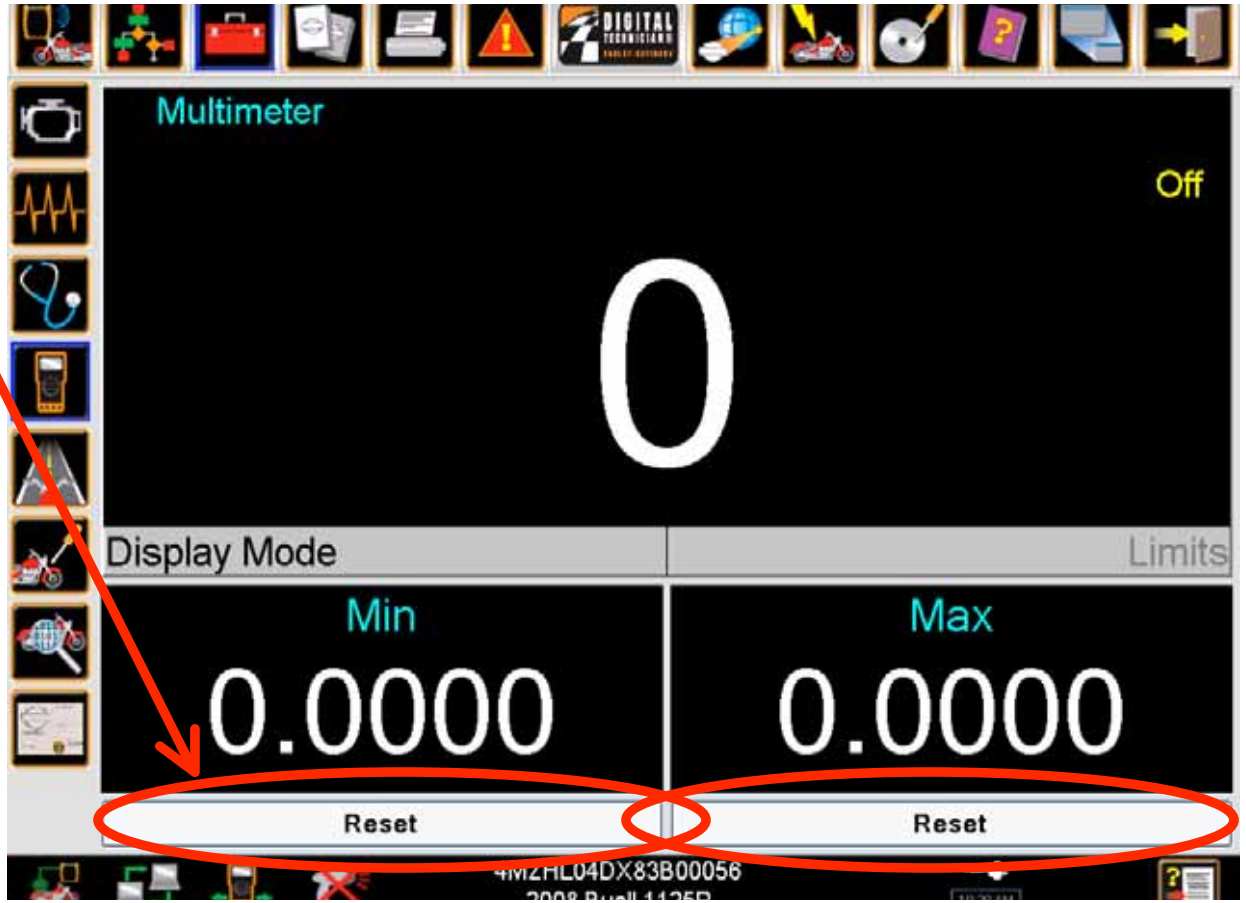
With fuel pump disconnected, press the STARTER button and crank the engine over for about 5 seconds.

(The engine may pop over a few times but will not start.)

Record the battery Min and Max values

(Ignore the values you see on this printed page.)

Disconnect the voltmeter when finished



Return to the DATA ITEMS screen by selecting the DATA ITEMS icon on the left edge of the screen.

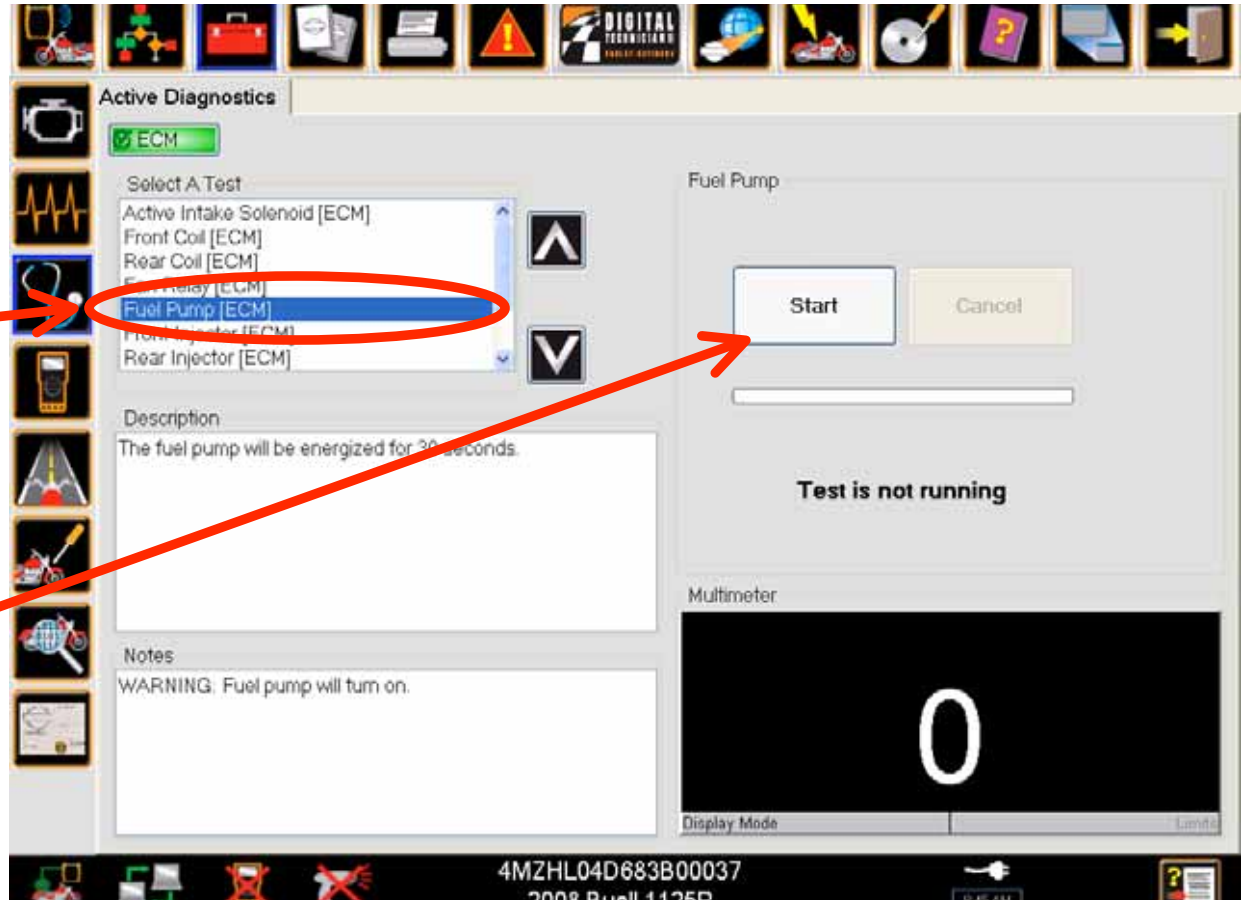
From the Value and Units column, record the current fuel pressure.

Reconnect the fuel pressure connector.

Next, Click on the circled Active Diagnostics icon

Click on the circled Fuel Pump (ECM) icon

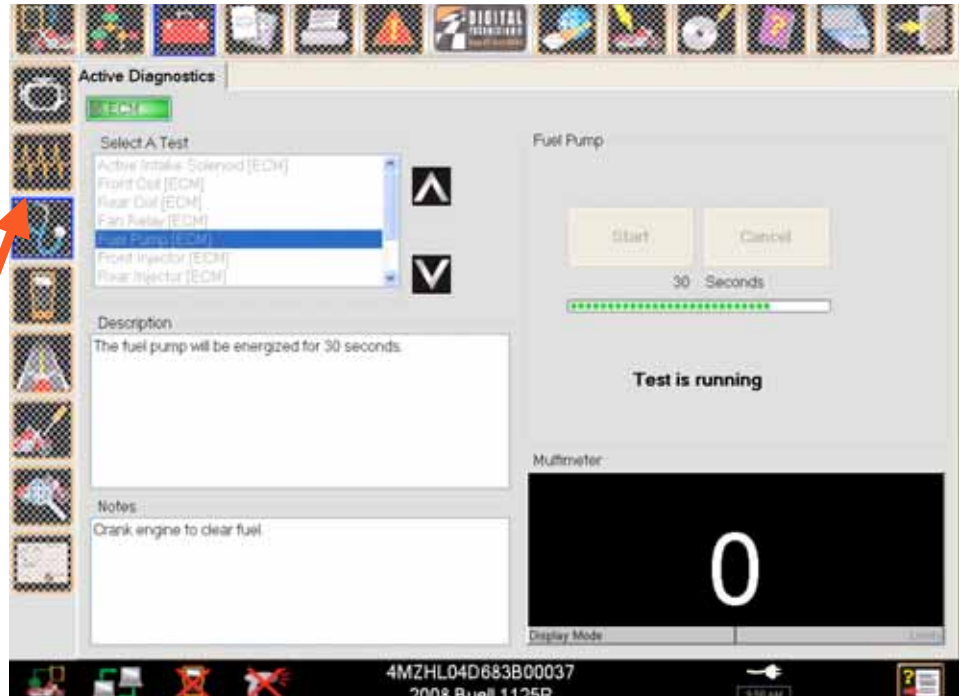
Then, click on the Start button



Next, read the warning and then click on the circled Proceed button

The fuel pump will activate for 30 seconds to reestablish system fuel pressure

The top screen is what you will see while the pump is activated. (Allow the pump to complete its 30 sec. test)



Next, click on the Data Items icon and record fuel pressure from the data screen on your answer sheet

CONGRADULATIONS !!!

- You have completed this work station test.

- Please hand your worksheet to your judge and organize your work area for the next contestant.

SkillsUSA
2009 Motorcycle Service Technology Contest

Written Test Answer Sheet

Buell P3 Blast Service Manual

Sponsored by

SkillsUSA
2009 Motorcycle Service Technology Contest

Written Test Key

Buell P3 Blast Service Manual

Sponsored by

SkillsUSA
2009 Motorcycle Service Technology Contest
Written Test Key
Buell P3 Blast Service Manual

1. C
2. C E
3. D
4. A
5. B
6. A
7. D
8. C
9. A
10. B
11. D
12. B
13. B
14. A
15. D
16. D
17. B
18. C
19. A
20. A

SkillsUSA
2009 Motorcycle Service Technology Contest
Written Test
P3 Blast Service Manual

CONTESTANT # _____

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____
11. _____
12. _____
13. _____
14. _____
15. _____
16. _____
17. _____
18. _____
19. _____
20. _____

SkillsUSA
2009 Motorcycle Service Technology Contest

Written Test Answers

Buell P3 Blast Service Manual

Sponsored by

SkillsUSA
2009 Motorcycle Service Technology Contest
Written Test Answers
Buell P3 Blast Service Manual

Objective: This written test allows the participant to demonstrate knowledge of Buell® P3 Blast motorcycle and the ability to locate specific information contained in the manual provided.

Directions: Reference the provided 2002 BUELL P3 BLAST FACTORY SERVICE MANUAL (PN 99492-02Y) for all test questions. Select the best answer(s) for each question, and then fill in the appropriate letter's box on the answer sheet provided.

1. The front wheel bearings should be inspected _____.

   A. every 10,000 miles.
   B. when the rear wheel is removed.
   C. when the front wheel is removed. pg. 1-5
   D. only when a grinding noise is heard.

2. The _____ brake fluid should be replaced every _____.
   (Choose 2 answers)
   A. ATF
   B. DOT 5
   C. DOT 4
   D. year.
   E. 2 years. C, E Pg, 4-97 and B-15
   F. 4 years.

3. What color is the wire that provides current to the ignition switch?

   A. Red (R)
   B. Yellow/Red (Y/R)
   C. Brown/Yellow (BN/Y)
   D. Gray (GY) Pg. B-12

4. The fuel valve is in the reserve setting when the arrow is pointing _____.

   A. right (rear). Pg. 1-33
   B. left (front).
   C. up.
   D. down.

5. The capacity of the fuel tank is 3.0 gallons.
   A. True
   B. False Pg 2-1

6. _____ is the proper torque specification for the rear muffler strap bolts

   A. 22-25 ft. lbs. Pg. 2-3, 2-54
   B. 22-52 ft. lbs.
   C. 100 in. lbs.
   D. Good and tight

7. The lateral runout of the front tire should not exceed _____.
   A. 8.000".
   B. 2.030".
   C. 0.800".
   D. 0.080". Pg. 2-18
   E. none of the above

8. The spark plug cable should have a resistance of _____ ohms.

   A. 0.00
   B. 2.375-5.833
   C. 2,375-5,833 Pg. 7-25
   D. infinity

9. The Pink (PK) wire at the ignitions coil connector [83B] goes directly to the ignition module.

   A. True Pg. 7-24
   B. False

10. On the ignition coil, pin C is _____.

   A. 12 VDC
   B. ground Pg. 7-24
   C. the front cylinder's primary coil trigger
   D. the rear cylinder's primary coil trigger

Ref. Ignition Test 2, Neutral Switch Function, Fig 7-31, Pg. 7-27 for the next 3 questions.

11. The vehicle set-up or Condition for the test should be _____.

A. sidestand up, key ON, transmission in neutral and clutch engaged.
B. sidestand up, key ON, transmission in neutral and clutch disengaged.
C. sidestand down, key OFF, transmission in neutral and clutch engaged
D. sidestand down, key ON, transmission in neutral and clutch engaged. Pg. 7-27

12. If the Voltage is found to be Battery Voltage minus 2 volts at the Diode 2 TN/Y and the GY you should _____.

A. check for continuity between TN/Y and Diode 2.
B. check for ground at TN on Diode 1. Pg. 7-27
C. repair wiring.
D. tell the customer that no faults were found.

13. If the ground is not present at TN on Diode 1, you should _____.

A. punch out and go home early.
B. check for ground at the neutral switch terminal . Pg. 4-60
C. check Diode 1 with an ohmmeter.
D. replace the Diode.

14. The m (circled 4) in the flow chart instructions on page 7-65 indicates that _____.

A. the seat should be removed. Pg. 7-63
B. order in which the tests are to be done.
C. a continuation point from another test flow chart.
D. the test needs to be done 4 times.

15. Terminal 8 of the Instrument Connector [20] is _____.

A. a Black (BK) wire.
B. a Red (R) wire.
C. a Green/Yellow (GN/Y) wire.
D. not used. Pg. 7-67

16. The specified torque for the lifter anti-rotation screws is _____.

A. 3-5 Nm.
B. 15-19 ft. lbs.
C. 80-110 in. lbs.
D. 55-65 in. lbs. Pg. 3-4, 3-54
E. none of the above

17. The Speedometer Diagnostic code indicating power over voltage is _____.

A. d01.
B. d08 . Pg. 7-59
C. CAL 14.
D. d10

18. When performing the Speedometer Performance Check with the Speedometer Tester (HD-41354), a frequency of 1803 Hz should reflect a speedometer display of _____ MPH on a USA market meter.

A. 20
B. 40
C. 60 Pg. 7-62
D. 80

19. The exhaust push rod is identified by a _____ colored band.

A. Black Pg. 3-33
B. White
C. Pink
D. Orange

20. The Throttle Position Sensor (TP) Voltage is checked with the throttle plate fully closed and should have a reading of _____.

A. .45-.55 VDC Pg. 4-26
B. .45-.55 ohms
C. .5 +/- .5 VDC
D. 5 +/- .05 VDC

SkillsUSA
2009 Motorcycle Service Technology Contest

Written Test

Buell P3 Blast Service Manual

Sponsored by

SkillsUSA
2009 Motorcycle Service Technology Contest
Buell P3 Blast Service Manual

Objective: This written test allows the participant to demonstrate knowledge of Buell® P3 Blast Motorcycle and the ability to locate specific information contained in the manual provided.

Directions: Reference the provided 2002 BUELL P3 BLAST FACTORY SERVICE MANUAL (PN 99492-02Y) for all test questions. Select the best answer(s) for each question, and then fill in the appropriate letter's box on the answer sheet provided.

1. The front wheel bearings should be inspected _____.

   A. every 10,000 miles.
   B. when the rear wheel is removed.
   C. when the front wheel is removed.
   D. only when a grinding noise is heard.

2. The _____ brake fluid should be replaced every _____.
   (Choose 2 answers)
   A. ATF
   B. DOT 5
   C. DOT 4
   D. year.
   E. 2 years.
   F. 4 years.

3. What color is the wire that provides current to the ignition switch?

   A. Red (R)
   B. Yellow/Red (Y/R)
   C. Brown/Yellow (BN/Y)
   D. Gray (GY)

4. The fuel valve is in the reserve setting when the arrow is pointing _____.

   A. right (rear).
   B. left (front).
   C. up.
   D. down.

5. The capacity of the fuel tank is 3.0 gallons.
    A. True
    B. False

6. _____ is the proper torque specification for the rear muffler strap bolts

    A. 22-25 ft. lbs.
    B. 22-52 ft. lbs.
    C. 100 in. lbs.
    D. Good and tight

7. The lateral runout of the front tire should not exceed _____.
    A. 8.000".
    B. 2.030".
    C. 0.800".
    D. 0.080".
    E. none of the above

8. The spark plug cable should have a resistance of _____ ohms.

    A. 0.00
    B. 2.375-5.833
    C. 2,375-5,833
    D. infinity

9. The Pink (PK) wire at the ignitions coil connector [83B] goes directly to the ignition module.

    A. True
    B. False

10. On the ignition coil, pin C is _____.

    A. 12 VDC
    B. ground
    C. the front cylinder's primary coil trigger
    D. the rear cylinder's primary coil trigger

Ref. Ignition Test 2, Neutral Switch Function, Fig 7-31, Pg. 7-27 for the next 3 questions.

11. The vehicle set-up or Condition for the test should be _____.

A. sidestand up, key ON, transmission in neutral and clutch engaged.
B. sidestand up, key ON, transmission in neutral and clutch disengaged.
C. sidestand down, key OFF, transmission in neutral and clutch engaged
D. sidestand down, key ON, transmission in neutral and clutch engaged.

12. If the Voltage is found to be Battery Voltage minus 2 volts at the Diode 2 TN/Y and the GY you should _____.

A. check for continuity between TN/Y and Diode 2.
B. check for ground at TN on Diode 1.
C. repair wiring.
D. tell the customer that no faults were found.

13. If the ground is not present at TN on Diode 1, you should _____.

A. punch out and go home early.
B. check for ground at the neutral switch terminal .
C. check Diode 1 with an ohmmeter.
D. replace the Diode.

14. The m (circled 4) in the flow chart instructions on page 7-65 indicates that _____.

A. the seat should be removed.
B. order in which the tests are to be done.
C. a continuation point from another test flow chart.
D. the test needs to be done 4 times.

15. Terminal 8 of the Instrument Connector [20] is _____.

A. a Black (BK) wire.
B. a Red (R) wire.
C. a Green/Yellow (GN/Y) wire.
D. not used.

16. The specified torque for the lifter anti-rotation screws is _____.

A. 3-5 Nm.
B. 15-19 ft. lbs.
C. 80-110 in. lbs.
D. 55-65 in. lbs.
E. none of the above

17. The Speedometer Diagnostic code indicating power over voltage is _____.

A. d01.
B. d08 .
C. CAL 14.
D. d10

18. When performing the Speedometer Performance Check with the Speedometer Tester (HD-41354), a frequency of 1803 Hz should reflect a speedometer display of _____ MPH on a USA market meter.

A. 20
B. 40
C. 60
D. 80

19. The exhaust push rod is identified by a _____ colored band.

A. Black
B. White
C. Pink
D. Orange

20. The Throttle Position Sensor (TP) Voltage is checked with the throttle plate fully closed and should have a reading of _____.

A. .45-.55 VDC
B. .45-.55 ohms
C. .5 +/- .5 VDC
D. 5 +/- .05 VDC

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ANSWERS

Written Test

Motorcycle Technology Theory

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Directions: Select the best answer(s) for each question, and then fill in the appropriate letter's box on the answer sheet provided.

1. Using the following information, calculate cylinder volume in cubic centimeters.

   Bore = 72.5 mm
   Stroke = 60.3 mm

   A. 248,394 cc
   B. 497.868 cc
   C. 248.934 cc
   D. 34.336 cc

2. Pre-ignition is:

   A. spontaneous ignition after normal ignition
   B. auto-ignition before normal ignition
   C. compression
   D. auto-ignition after normal ignition

3. The intake valve opens in which quadrant?

   A. BTDC
   B. ATDC
   C. BBDC
   D. ABDC

4. The exhaust valve opens in which quadrant?

   A. BTDC
   B. ATDC
   C. BBDC
   D. ABDC

5. Valve overlap occurs at the:

A. end of the combustion stroke and the beginning of the exhaust stroke
B. end of the compression stroke and the beginning of the combustion stroke
C. end of the exhaust stroke and the beginning of the intake stroke
D. end of the intake stroke and the beginning of the compression stroke

6. Intake valve area is commonly _____ that of the exhaust valve.

A. greater than
B. the same as
C. less than
D. hotter than

7. The job of the camshaft is to:

A. drive the crankshaft
B. dampen valve spring oscillations
C. run the oil pump
D. control when, how fast, how far, how long the valve is opened

8. Which of these components changes reciprocation motion into rotary motion?

A. rocker arm
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9. The intake port of a piston –port two-stroke engine typically:

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10. A two-stroke engine with a leaking wet (clutch) side seal will exhibit which symptom?

A. run lean
B. smoke excessively
C. none of the above
D. all of the above

11. Changing a 32:1 pre-mix ration to 50:1 will:

A. put more oil in the fuel/oil mixture
B. put less oil in the fuel/oil mixture
C. lubricate the engine better
D. have no effect

12. Overdrive is a gear that is numerically:

A. less than 1:1
B. more than 1:1
C. 1:1
D. none of the above

13. If the transmission output sprocket has 14 teeth, and the rear wheel sprocket has 44 teeth, what would the final drive ratio be?

A. 3.143:1
B. 2.333:1
C. .318:1
D. 40.000:1

14. Clutch drag is:

A. the clutch does not transfer 100% of the engine's powerflow
B. clutch friction plates contaminated with oil
C. the clutch will not fully disengage
D. a clutch with worn out clutch springs

15. The largest driven gear found in a 5-speed indirect drive transmission will be:

A. C5
B. C1
C. M5
D. M1

16. The four purposes of motor oil are:

A. clean, cool, seal, quiet
B. clean, cool, seal, lubricate
C. clean, cool, seal, motivate
D. clean, cool, seal, calcify

17. The _____ is a lubricating system that stores oil in a remote tank.

A. wet sump
B. centrifugal
C. splash
D. dry sump

18. a 20W-50 multi-viscosity motor oil is one which:

A. is both 20 weight and 50 weight oil combined
B. thickens less when cold than a 20 weight and thins less when hot that a 50 weight
C. is a 20 weight mixed with 30 weight
D. thins less when cold than a 20 weight and thickens less when hot than a 50 weight

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C. ball bearing
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21. Which one of these is one of the four purposes of bearings?

A. support radial and/or axial loads
B. lubricate
C. impressibility
D. permeability

22. In a liquid cooling system, the thermostat:

A. allows for quicker engine warm up time
B determines the cooling system's operating pressure
C. is a heat exchanger
D. sends electrical data to the instrument panel

23. In a liquid cooling system, the _____ determines the cooling system's operating pressure.

A. thermostat
B. water pump
C. radiator
D. radiator cap

24. Octane is the fuel's ability to:

A. increase mechanical efficiency
B. resist chemical breakdown
C. resist detonation
D. increase stroke efficiency

25. The main purpose of oxygenated fuels is to:

A. improve fuel mileage of the engine
B. reduce CO2 emissions
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26. Air density:

A. refers to the amount of oxygen in a given space
B. decreases as altitude decreases
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27. An air/fuel ratio of 12:1 has:

A. 12 parts air (by volume) to 1 part fuel
B. 1 part air (by volume) to 12 parts fuel
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28. The force that results from an electrical pressure difference is called:

A. watts
B. ohms
C. amps
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29. Which of the following formulas is correct?

A. Volts = Amps X Ohms
B. Volts X Ohms = Amps
C Ohms ÷ Amps = Volts
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30. The two major types of charging systems are:

A. rising field, collapsing field
B. excited field, normally open
C. permanent magnet, full wave
D. permanent magnet, electromagnet

31. The three strengths of charging systems are:

A. half-wave, full-wave, permanent magnet
B. half-wave, full-wave, sine-wave
C. half-wave, full-wave, 3-phase
D. permanent magnet, electromagnet, rising field

32. The ignition coil's _____ windings has more wire turns than it's _____ winding.

A. solenoid; starter
B. field; stator
C. secondary; primary
D. primary; secondary

33. An ignition coil operates on the principle of:

A. polarity
B. grounding
C. residual magnetism
D. mutual induction

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KEY

Written Test Answer Sheet

Motorcycle Technology Theory

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Written Test

Motorcycle Technology Theory

KEY // KEY // KEY // KEY // KEY // KEY //KEY

1. _____C_____
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17. _____D_____

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2009 Motorcycle Service Technology Contest

Written Test Answer Sheet

Motorcycle Technology Theory

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Written Test
Motorcycle Technology Theory

CONTESTANT # _____

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